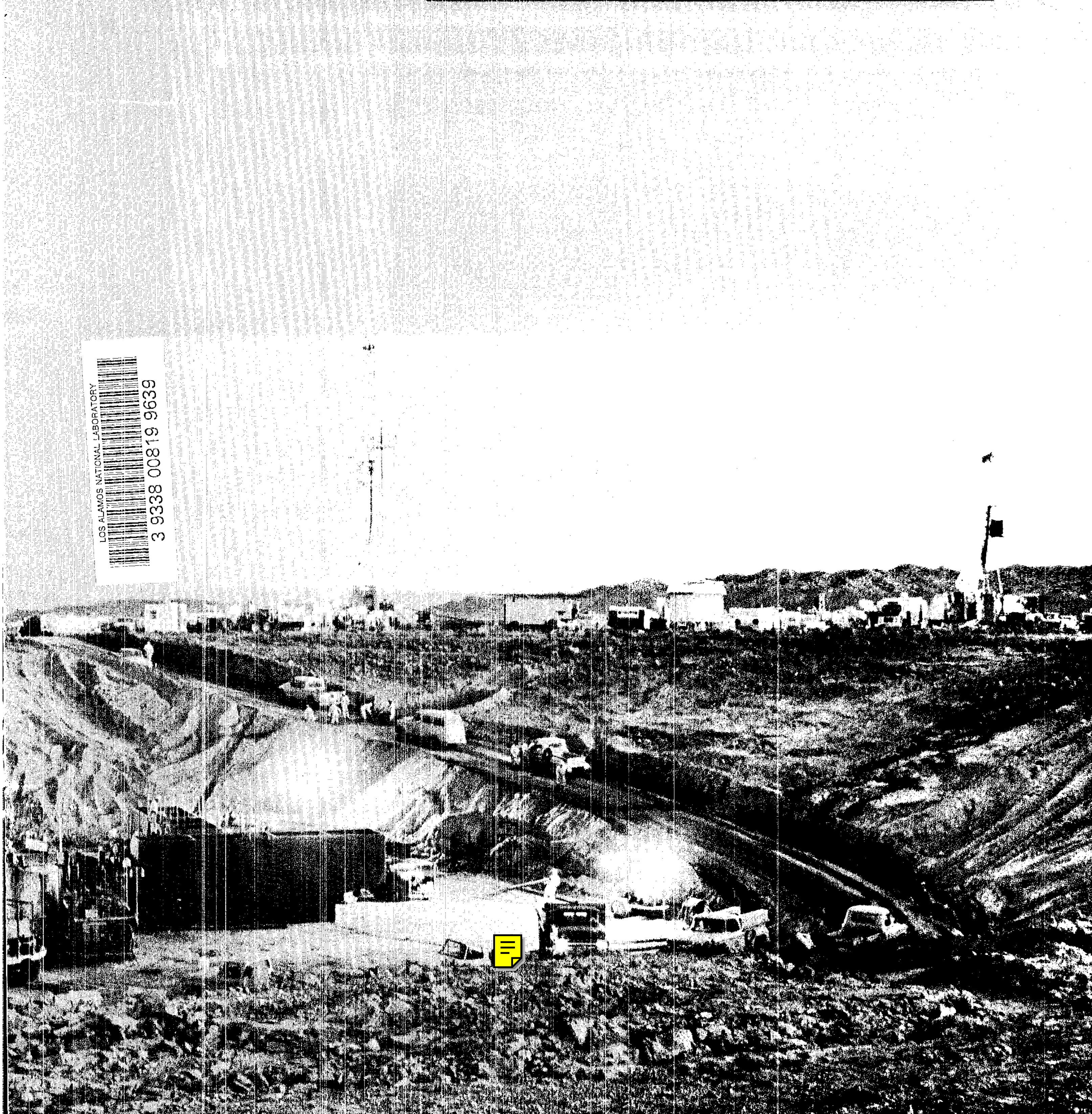
THE ATOM

Los Alamos Scientific Laboratory June, 1966



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THE ATOM

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COVER:

Floodlights begin to take hold on Nevada desert as drilling crews continue quest for nuclear samples far underground. Scene was photographed last month during LASL's Cyclamen Shot operations. See story on page 1.

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about this issue

Last month at the Laboratory's Nevada Cyclamen shot, (see story on facing page), Bill Jack Rodgers (left) and his Hasselblad camera were in action for nearly 27½ hours—*straight.* There were a few catnaps on a car seat, to be truthful. But, mostly, Atom Photographer Rodgers moved apace, crawling over cables, around derricks, up terraces, through equipment—jockeying for positions for the 450 black-and-white and 150 color frames he exposed.

Nevada is no stranger to Rodgers. In his seven years with the Laboratory (2½ of these with public relations), the 39-year-old photographer has made 50 trips to the sere, sun-saturated desert northwest of Las Vegas. Some of the excursions lasted months. Such long stays must, sooner or later, engender either attachment or loathing of the desert. Rodgers loves it. Why? "Its bleak simplicity, I think," he says. "It can be a very deadly place." His weekends there are usually spent in exploration of obscure places.

It was, to begin with, this unflappable Iowan's sense of curiosity that led him to LASL. On a visit to Taos Pueblo from Iowa in the late 'fifties, Rodgers noticed another car with Iowa plates. He inquired and found his fellow Iowans were visiting with GMX-3's Bob Wright, himself a former Midwesterner. At Wright's bidding, Rodgers wrote the Laboratory; a few months later, he was hired.

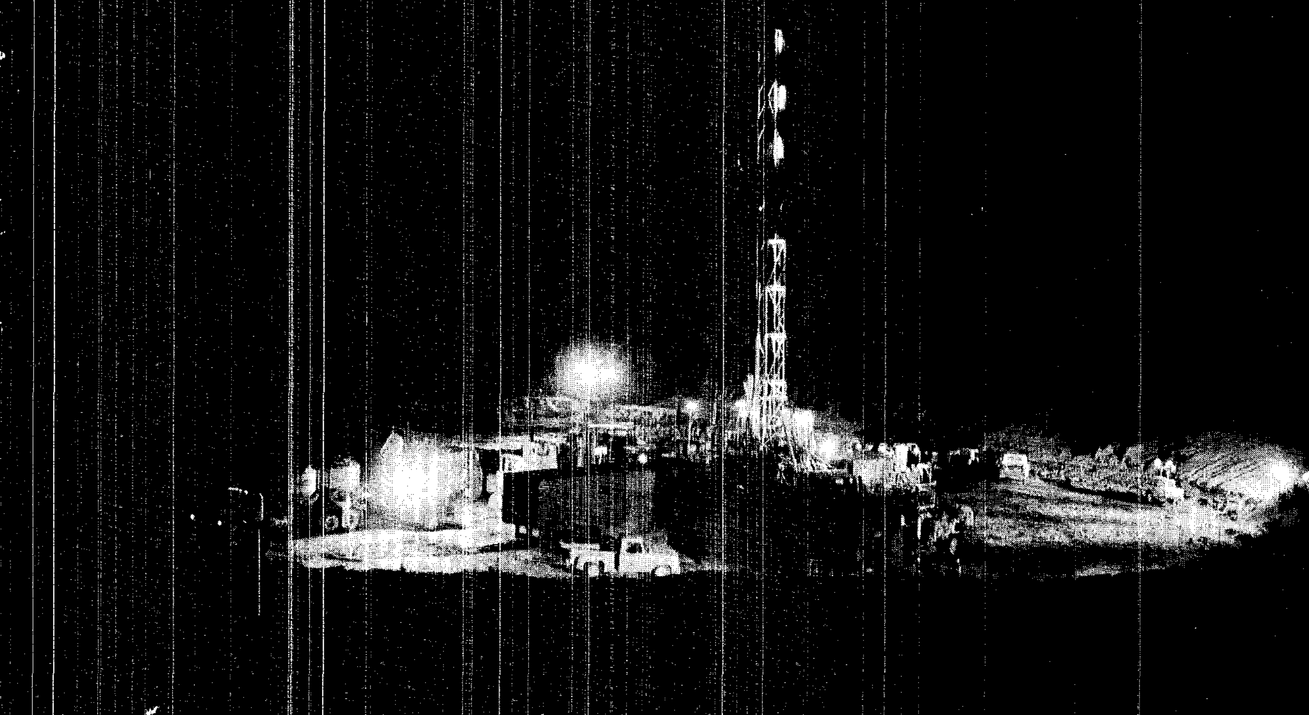
"A shot out of the blue," he says, but one that, last month, resulted in his presence at his sixth Nevada underground shot.—Editor.

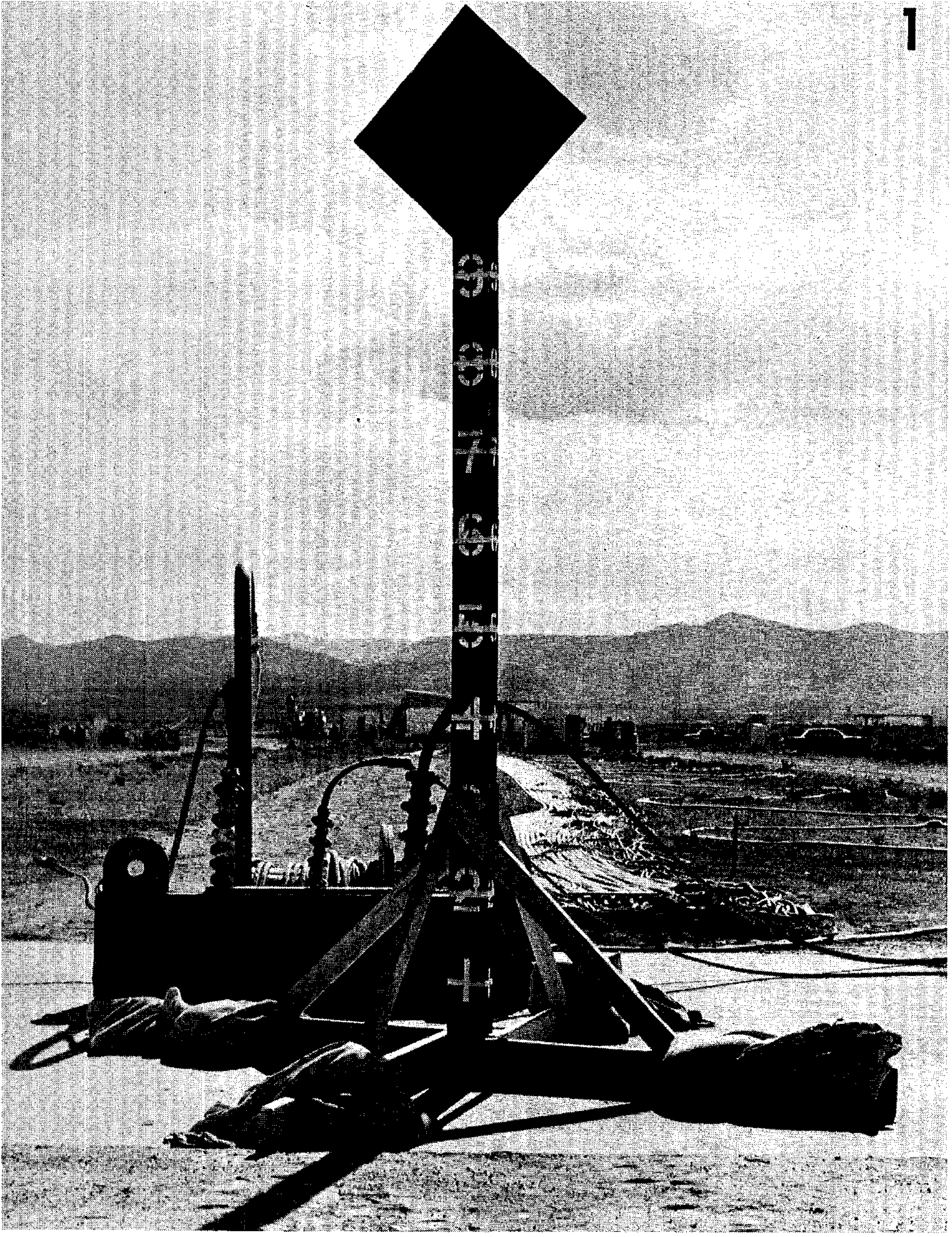
A New Frontier

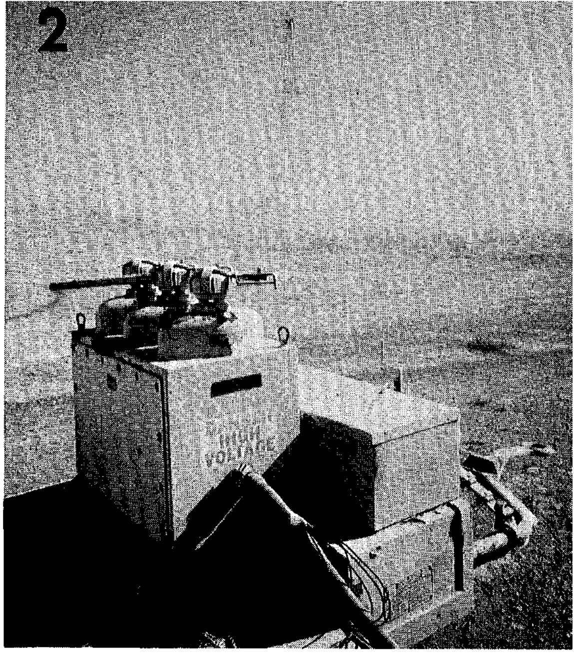
UNDERGROUND NUCLEAR BLAST MAY HAVE PRODUCED MAN'S HEAVIEST SUBSTANCE

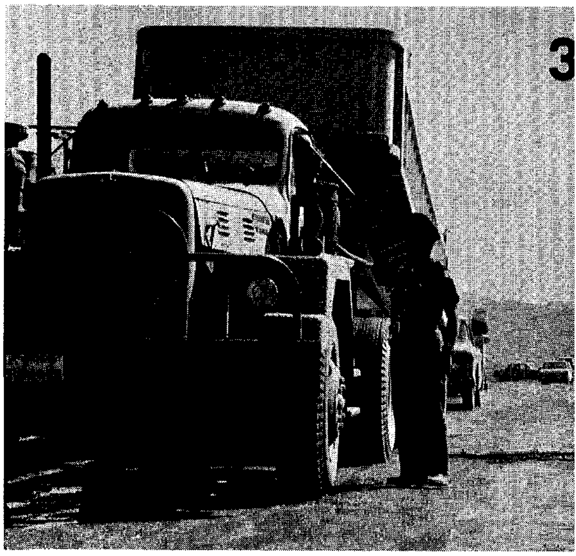
BY EDWARD WALTERSCHEID

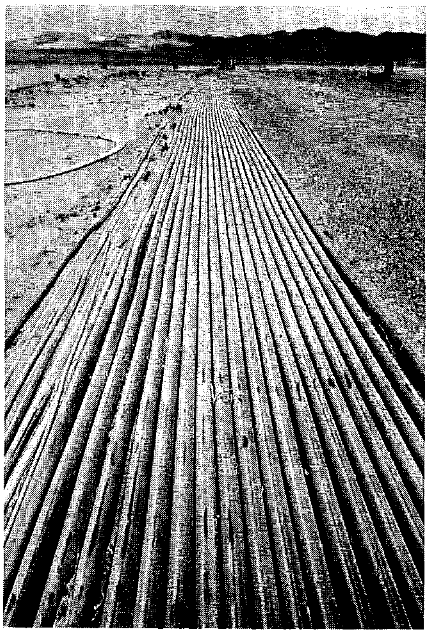
● Since medieval times, man has attempted to transform one element into another. But where the alchemists sought to change base metals into gold, today's scientists seek to make completely new elements—heavier than any now known. To produce these heavy elements, they have turned to one of the most potent neutron research tools known: nuclear explosives. ● On May 5, LASL conducted Cyclamen, the most successful heavy element experiment to date involving the use of nuclear explosives. There is some evidence to suggest that the experiment, which utilized a device designed by T-Division Leader Carson Mark and collaborators, produced the heaviest substance yet isolated. ● Nuclear explosives are used in the synthesis of heavy elements because they produce vast quantities of neutrons in less than a millionth of a second. When these neutrons strike a suitable target, such as natural uranium, many of them are instantaneously captured. The nuclei of target atoms that have captured such neutrons then undergo a nuclear transformation known as beta decay in which new heavier elements are formed. ● In Cyclamen, the target material was uranium 238 (element 92) together with a small amount of americium 243 (element 95). This material was bombarded by the most intense burst of neutrons ever produced. The burst was equivalent to a total of seven tril-/*continued*











1 Numbered pole and mortar board mark ground zero.

2 Ever present dust was a constant harassment.

3 Security measures are in force 48 hours before shot.

4 Tony Miera of J-6 supervises filling of shot hole.

5 Firing and diagnostics cables lead toward shot hole.

Cyclamen

Continued

lion neutrons passing through a square centimeter – about the size of an average fingernail.

The most intense neutron flux produced thus far in a reactor is about 10 million billion neutrons passing through a square centimeter each second. The flux produced by Cyclamen was more than a million times more intense than this.

Not only was the neutron flux produced in Cyclamen better than any heretofore available, but the low yield—about 11 kilotons—means that future detonations with devices of this type can be completely contained underground—as indeed Cyclamen was. This is important for two reasons: First, it means that heavy element experiments can be conducted within the restraints imposed by the nuclear test ban treaty. Secondly, the debris from the explosion is contained in a relatively small volume underground. Unfortunately, however, this volume is not as small as the radiochemists would like.

A problem with heavy element synthesis in nuclear explosions is the difficulty of recovering a sufficient amount of the target material within a short enough time to permit isolation and detection of new isotopes. Unless the recovery is made within a day or two, the short half-lives of many of the heavier isotopes preclude their detection. Typically, at Nevada, only about a billionth of the target is recovered for analysis. This means that extremely sophisticated radiochemical techniques must be used in the search for new isotopes of the heavy elements.

In a contained underground explosion, the target material is instantly vaporized, although not before being irradiated by the tremendous neutron flux. The vaporized target then forms part of the expanding cavity gas. When the cavity has expanded to its maximum dimensions, the gases condense on melted wall material, which then slumps to a pool at the bottom.

This is a help because it serves to concentrate the target material into a smaller volume. Unfortunately, however, at Nevada the cavity invariably collapses within a short time after the detonation, dropping literally thousands of tons of dirt and rock into the melt. This collapse also causes a crater to form at the surface. The crater for Cyclamen was about 550 feet in diameter and about 55 feet deep.

Cavity collapse tends to make life more difficult for the radiochemists. Not only does it dilute the melt containing the remains of the target material, but because of the crater it also complicates the drilling operations to recover samples.

Until postshot drilling began, Cyclamen was a standard shot for J Division, which is responsible for performing all nuclear tests by the Laboratory. But the need to first recover a number of small samples as quickly as possible and then, as soon as practicable, recover much larger samples caused a considerable departure from the normal postshot drilling routine.

To insure that the recovery operation proceeded as rapidly as possible, Bob Campbell, J-DO, who served as test director for Cyclamen, engaged in a little psychology. As he put it, "We gave a little pep talk to the various people engaged in the operation. You can't expect them to put an extra effort into every shot, but we asked them to for this one. They did, and it helped a lot."

Three drill rigs were used to recover samples. Two were positioned outside the crater and one—to recover very large samples of melt—was placed in the crater. To further speed the recovery process, the two rigs adjacent to the crater were set up before the shot and left in place during the detonation. Three and one-half hours after the shot, one of these rigs had commenced drilling, and some 12 hours later had recovered its first sample from just beneath the shot point, 1,000 feet below the surface.

Twenty-four hours after the shot, 14 core samples from this rig were loaded aboard a DC-3 at Camp Desert Rock, just outside Mercury, Nevada, for the trip to Los Alamos for analysis. At Los Alamos, they were rushed to the radiochemistry building (TA-48) where most of the radiochemistry group (J-11) stood by for action.

The cores were immediately washed to remove drilling mud and 250 grams (a little more than

Continued

Cyclamen

Continued

half a pound) of the most radioactive rock picked out for immediate analysis. This rock was dried, pulverized to the consistency of face powder, and placed in a boiling mixture of nitric, perchloric, and hydrofluoric acids.

This was the first part of a series of steps to separate the actinides from the rest of the rock and debris in the sample. Actinides are a second series of "rare earth" elements beginning with element 90, thorium, and extending through element 103, lawrencium. The series includes all the heavy elements thus far synthesized. Element 104, which is no longer an actinide and should presumably resemble zirconium and hafnium in its chemical properties, may have been synthesized by the Russians, but no other laboratory has yet confirmed their tentative claim.

These steps can be done rather simply through gross chemical techniques; the real problem is separating and identifying each individual actinide. This was done by passing the mixture of actinides through an ion exchange column. This is a quartz tube packed with granular ion-exchange resin. As the mixture passes through the column, the ions of each element repeatedly associate and disassociate with the resin.

The higher atomic number actinides pass through the resin more rapidly than those of lower atomic number. Because of this, the individual elements can be separated and identified. The liquid leaving the column is collected drop by drop, evaporated on platinum plates, and then each drop is individually counted for its radioactivity, which will be different for each isotope.

About 26 hours were required to isolate individual actinides from the first 250-gram sample. Some 54 hours had elapsed since shot time. This set a new record for quantity of material recovered and analyzed in such a short time.

The actual quantities of the heaviest actinides present in this sample were too small to be weighed. However, the exact number of atoms of each isotope could be calculated from their radioactivity.

While the first sample was being analyzed at Los Alamos, efforts to obtain even larger samples were continuing in Nevada. About 24 hours after the shot, the much larger drill rig within the crater began operation. Fourteen hours after drilling

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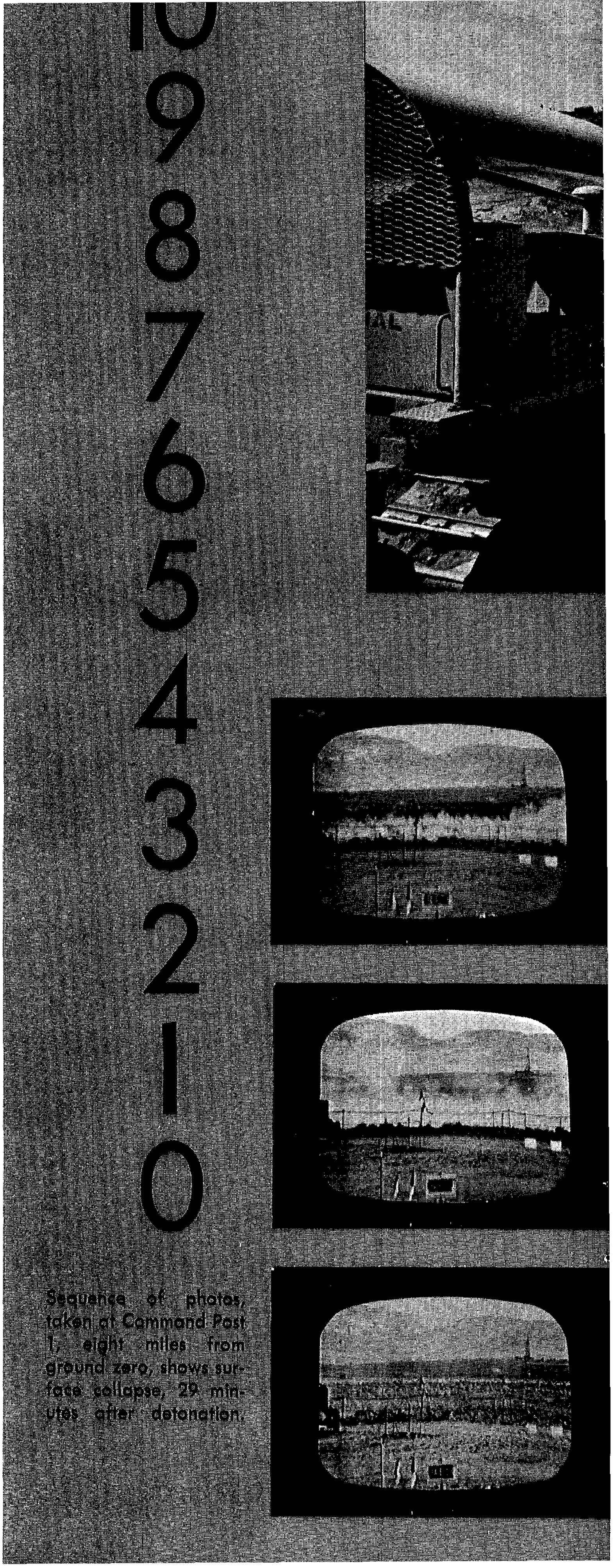
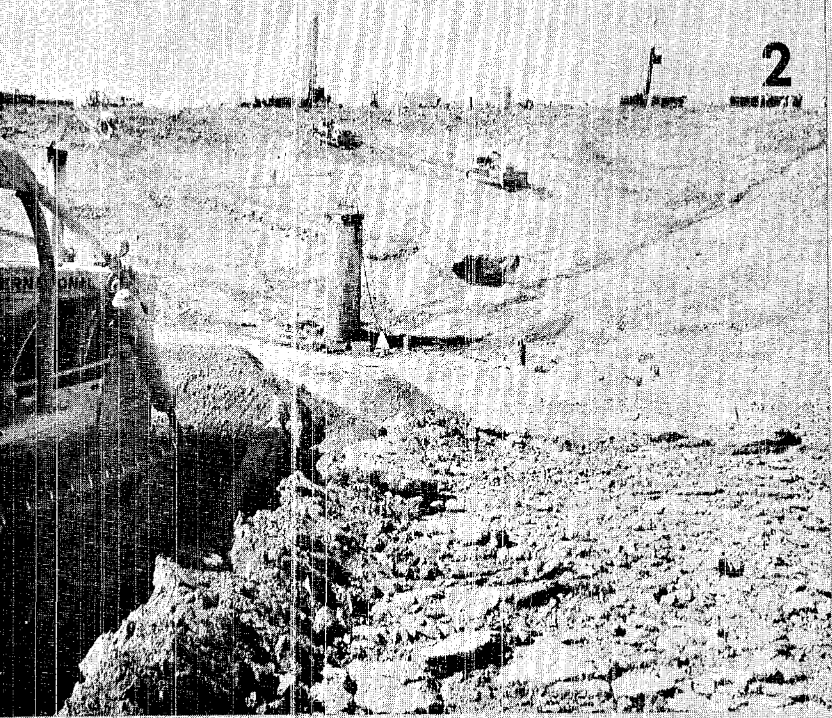
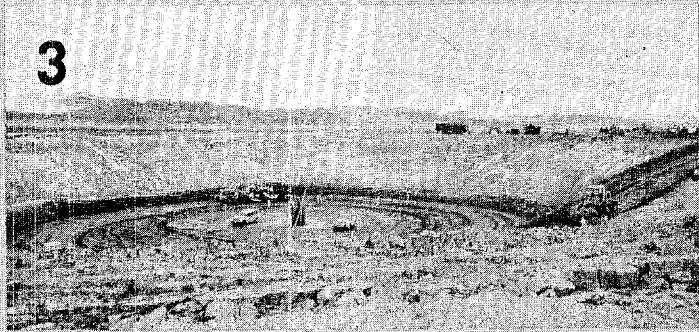
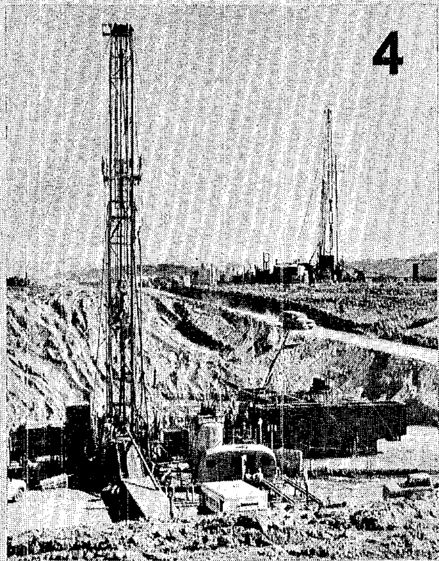
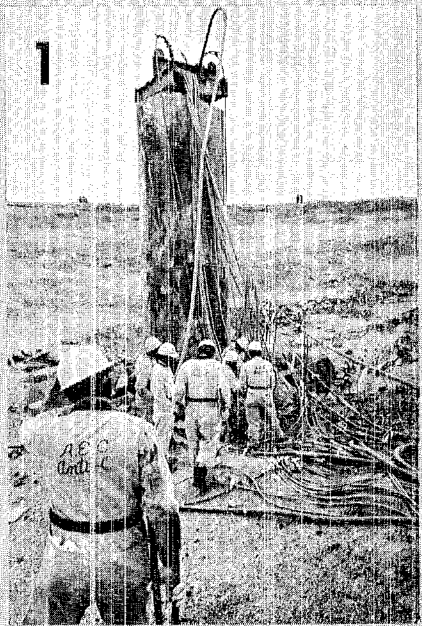


Sequence of photos, taken at Command Post 1, eight miles from ground zero, shows surface collapse, 29 minutes after detonation.









1 First workmen to enter shot area after radiation checks were made prepare to remove cables so crater can be partially filled.

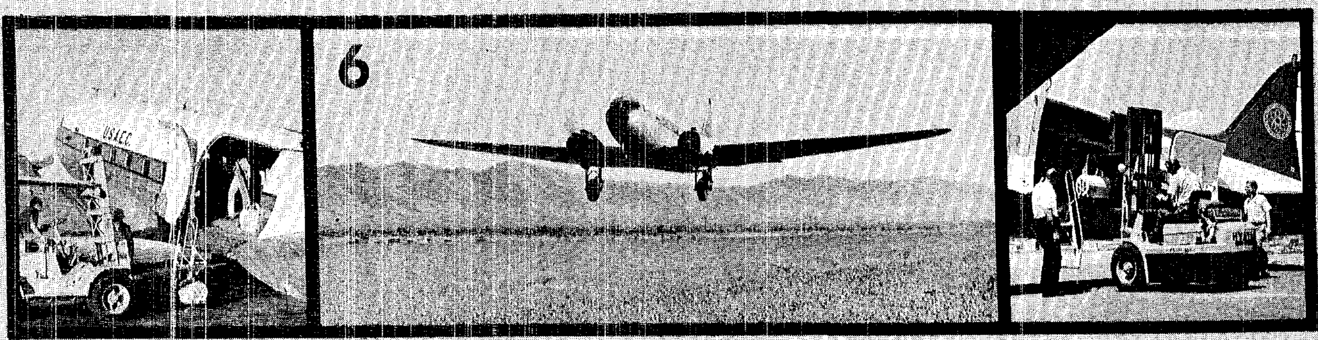
2 A little over two hours after detonation, bulldozers rush in to prepare surface crater for arrival of drilling equipment.

3 Eight hours after earthmoving equipment entered area, leveling around ground zero is virtually complete.

4 Drilling rigs, in crater and on desert above, are cutting toward underground shot debris 36 hours after blast.

5 At this high-grading operation, core samples are washed to remove drilling mud and other undesirables.

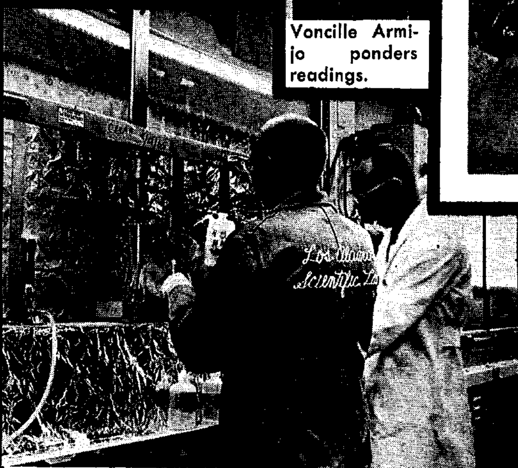
6 First samples were available 24 hours after shot. DC-3 makes first of several flights from Test Site to Los Alamos.



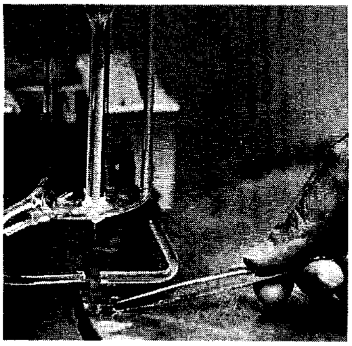
Ted Shull, with radioactive tiger by the tail, heads toward dissolving room with debris samples just arrived from Nevada.

Test for element 104 is made by Rene Prestwood. It wasn't there.

Voncille Armijo ponders readings.

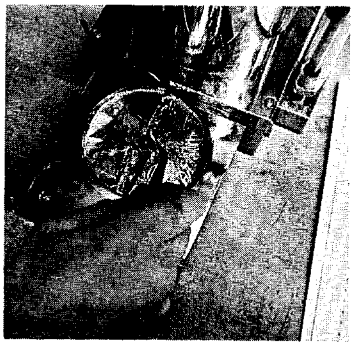


Gordon Knobeloch (left) and Carl Orth dissolve shot debris behind wall of lead bricks.

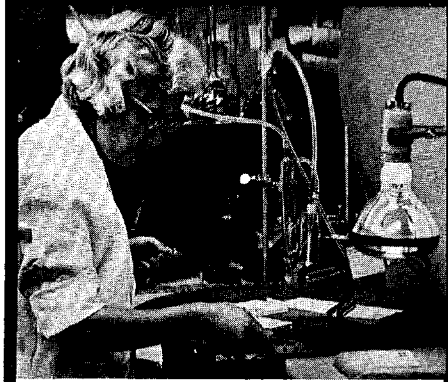


The Product

Hours after blast and hundreds of miles away, this limpid drop, emerging from resin column, is read (below) for radioactivity to help LASL scientists decide what, if any, new material they have made.

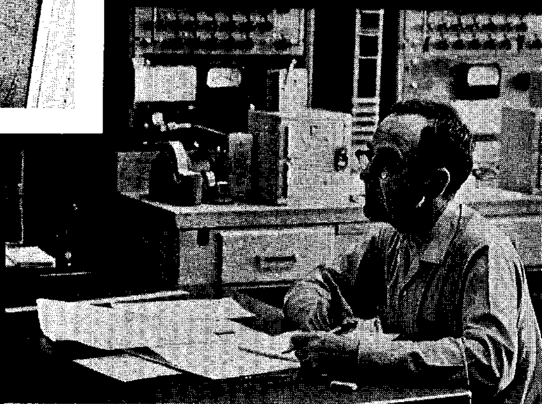


Large-scale solvent extraction apparatus is operated by Bill Daniels (foreground) and Eldon Hitchcock.



Sample plates, carrying drops from resin column, are removed by Pat Oliver.

Sara Helmick watches while alpha particle count is made on sample plates.



George Cowan, J-11 group leader, evaluates preliminary Cyclamen results.

Cyclamen

Continued

began, it was producing core samples five times larger than the first cores sent to Los Alamos.

These large core samples were processed through a "high-grading" facility near the crater. Here, they were removed from the steel coring jacket, washed, dried, and any pieces larger than one-half inch in diameter picked out for shipment to Los Alamos. Twenty-eight of these large cores were processed through this facility. Material from the first five cores was sent to the Lawrence Radiation Laboratory at Livermore and Berkeley, Calif., for analysis. Large samples from the later cores were sent to Los Alamos and also to Argonne National Laboratory, Argonne, Ill.

Before the Cyclamen experiment, the heaviest material made by man was an isotope of element 100, fermium, with a mass of 257. Cyclamen produced 10 times more fermium than had ever been made before. This improvement in performance has also resulted in the synthesis of nuclear species heavier than mass 257 in sufficient quantities to permit their identification if their lifetimes are longer than a day or two but not so long that they cannot be detected by their radioactivity. It will require a few more weeks of analysis to determine if such isotopes have actually been measured.

Is the production of heavy elements worth the trouble of employing a nuclear detonation? Indeed, it is. For heavy element experiments provide a fuller understanding of the chemistry and physics of our entire environment. Studies of heavy elements are significantly increasing our knowledge of the stable, lighter elements; the fission process; and the origin of the earth, the stars, and the universe.

For George Cowan, J-11 group leader and associate J-Division leader, experiments such as Cyclamen have an additional meaning. As he expresses it, "The old rule for identifying an element was the ability to isolate it chemically. In recent years, less direct evidence has been used--but the new rules have produced some scientific arguments. In experiments such as Cyclamen, we can hope to make enough atoms of the new element to return to the solid ground of chemical identification. The neutron source is now good enough to make such products in sufficient quantity. The problem is now to demonstrate that some of them are reasonably long-lived."

An experiment such as Cyclamen is impossible without the wide ranging capabilities that exist in the various divisions of the Laboratory. The success of Cyclamen required the efforts of wide segments of J Division, T Division, W Division, and CMB Division, as well as a host of smaller groups.

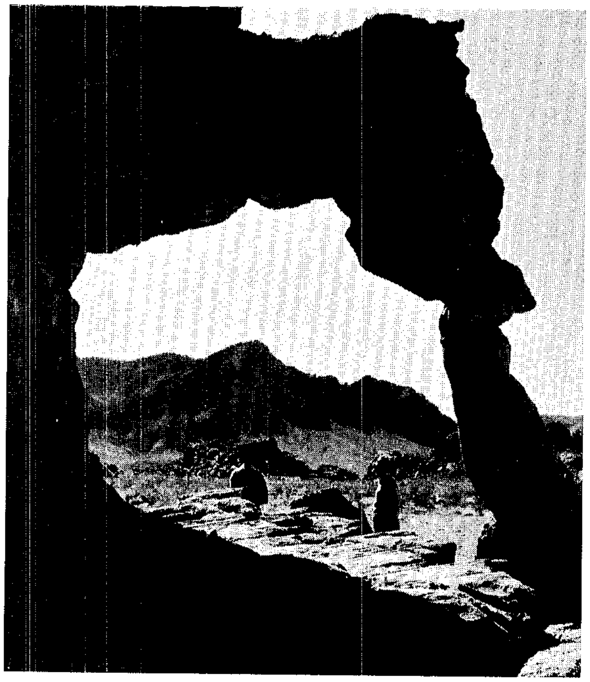
A visitor to the Nevada Test Site quickly becomes aware that answers concerning questions about test operations are almost invariably prefaced by the cautious phrase: "If all goes well. . . ." The most enthusiastic words of praise for an experiment are that "things went fairly well." With Cyclamen, things went fairly well.

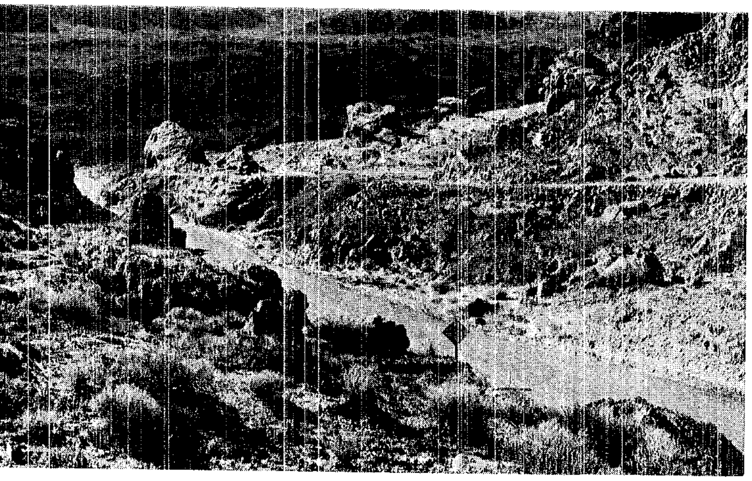
AEC's C. C. Campbell Given Additional Duties

Charles C. Campbell, manager of the Los Alamos Area Office of the Atomic Energy Commission, was assigned additional duties last month that will eventually result in his transfer to Albuquerque.

Campbell, manager for the AEC here since June of 1962, was named deputy assistant manager for administration at the Albuquerque Operations Office headquarters. The appointment was effective on May 15. He will remain at Los Alamos until requirements of the community disposal program, which began in 1962, permit his transfer. Most of the major policy decisions associated with the program are expected to be completed this year, according to the AEC.

Campbell has been associated with the U.S. atomic energy program since 1943. He served in both military and civilian capacities with the Manhattan Engineer District and joined the AEC when it was formed in 1947. Previous to his appointment as Area Office manager here, he was manager of the Sandia Area Office and deputy area manager at Rocky Flats, Colo., and had held various assignments in the personnel and labor relations field at Los Alamos and at Albuquerque Operations Office headquarters.





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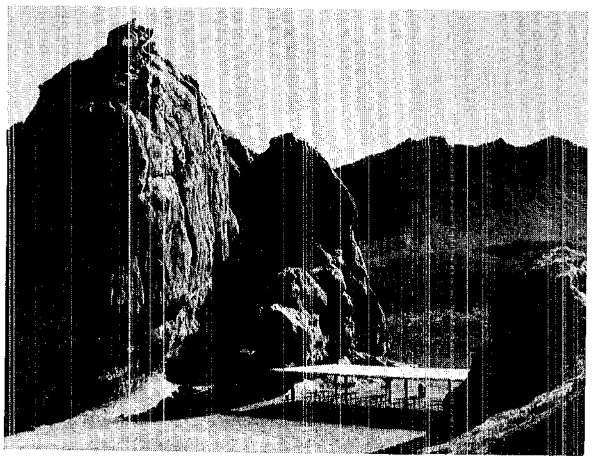

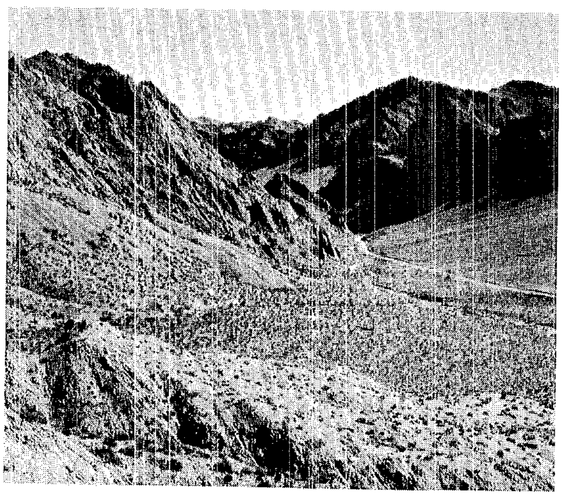

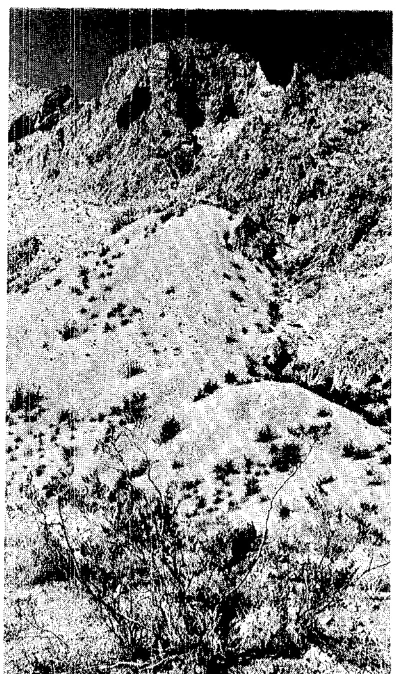

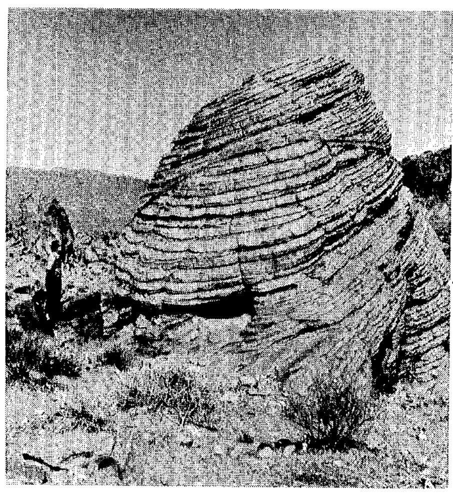

Red Sandstone, Eroded Into Bizarre Shapes, Makes Up Nevada's Largest, Brightest State Park

A commingling of bizarre geologic formations and evocative prehistoric vestiges awaits Laboratory employes in Nevada who motor to the desert stretches about the northernmost shores of Lake Mead.

Here, in a blaze of natural color exuding from a grotesque kingdom of oddly shaped rock, is found the aptly named Valley of Fire, a writhing swatch of terrain that forms Nevada's largest state park.

Reached on State Route 40, which leaves U.S. Hwy. 91 about 35 miles northeast of Las Vegas, the fiery red hues of the state park form the marquee for a theater-in-the-raw, featuring flashbacks into a culture now dead many hundreds of years.

This culture is, of course, that of the early Pueblo Indians, precursors of the communal immigrants that swept down into the Rio Grande Valley of New Mexico in the 1300s.

The Nevada branch of this consanguineous people nestled in the Moapa Valley, in a 30-mile-long indentation that runs north from what is now Lake Mead. Ruins of their dwellings number more than 2,000, archeologists report, and a museum on State Route 12 below Overton contains many of the artifacts that have been found.

The region that is now the Valley of Fire State Park is believed to have once been the hunting grounds for the early Pueblos.

No doubt the multifarious designs in the eroded red sandstone evoked a variety of responses from the superstitious Indians. There is —and was then—an abundance of shapes and formations, some huge and monolithic, others modest and intricate, that suggest both animate and inanimate objects—elephants, beehives, skulls, dragons, whales, giants.

Ruggedness is no rarity in Nevada, but, from the wrenched surfaces underfoot to the contorted outcroppings high overhead, Valley of Fire has few, if any, peers. This region, to carry further the image suggested by its name, looks as if it had instantly cooled while in the throes of a fiery assault.

From State Road 40, which threads its way amid the burnished spires, canyons branch off to each side. In several of these, up against a dollop of creased stone or in the shadows of an overhang, picnic facilities are provided, with tables, water, trash receptacles and canopies.

The nooks, crannies and boulders have collected some droll names. Like Atlatl Rock—named after an Indian throwing stick. And Mouse's Tank, a borrowed cognomen from a renegade Indian murderer who successfully eluded his pursuers for many years.

The archeology of the region is best reviewed at the Lost City Museum, near Overton. The museum takes its name from the fate of the area's largest pueblo, El Pueblo Grande de Nevada, which was partially covered by water when Lake Mead backed up. In fact, the museum was expressly established to house relics and artifacts excavated before the inundation.

Archeologists suggest that the Moapa Valley was the domicile for 15,000 Pueblo Indians in its swinging days. The valley was the center for a tremendous trade and hunting area—one which, on the west, reached into and beyond the present-day Nevada Test Site.

The big trade items were salt and turquoise. Low-grade turquoise was mined by open pit methods near the site of Hoover Dam; salt was extracted from tunnels.

The Indians evinced considerable sophistication in their land tillage. They used the rich river bottoms for agriculture and built a series of brush dams and irrigation channels to get water to their crops.

When all the scraps of evidence are in, the verdict is that these so-called aboriginal people—who lived along the river banks and hunted in the valley where the sandstone blazed like fire—reached the highest degree of culture to be found among prehistoric Indians—U.S.A. version.

Powder Metallurgy's Growing Role

by Dudley Lynch

Space-age impetus has given new depths, dimensions and duties to a specialist in the scientific community who is increasingly being thrust into the role of a troubleshooter.

He is the powder metallurgist.

It is his skills that are so avidly sought when exotic metal mixtures or complicated designs in metals are needed. Not unrarely, the formula he eventually devises from his apothecary's selection of powders and the object that emerges from his console blend of pressures and temperatures are made only with the greatest difficulty, or not at all, by other means.

This has been particularly true at Los Alamos. In numerous instances here, it has been the powder metallurgist's ability to shuffle materials into so-called super-combinations that has opened new doors for stalled researchers. With the growing specifications gauntlet through which research and weapons components must pass, his ascendancy shows no signs of diminishing.

Maze of tubes and columns is used by Chuck Fairchild, right, and Don Bowdish to measure the gas content of metals.

The Laboratory's powder metallurgy section is a part of CMB-6, the materials technology group headed by James M. Taub. This section employs 17 persons (five of whom are staff members) who work with an array of metalworking, fabricating and testing equipment valued at nearly a million dollars. Included in this versatile assortment are hydraulic presses, high frequency induction coils, pressure chambers, blending mills, arc furnaces, dry boxes, gas cylinders and a commissary's list of other items. Many of the presses are capable of operating at high pressures, to 400 tons, and high temperatures, to 3,000 degrees centigrade. The section's powder evaluation laboratory—a kind of Mayo Clinic for metal particles—is possibly the finest in the country.

With this outlay of tools and equipment, LASL's powder metallurgists ply their trade—namely, the fabrication of articles from powders.

These articles are commonly of two main categories: items that cannot easily be made any other way and items that could be made by other means but not so conveniently or so economically. Usually, the techniques involve heating a metallic powder to high temperatures and applying tremendous pressures or a single, specialized use of just one of these methods.

The man to see if you need a metal mixture coerced into utility is Robert Riley, powder metallurgy section leader. Riley, a California expatriate, joined the Laboratory staff in 1962. He formerly was employed by Aerojet-General Corporation at Azusa. He is assisted by the five staff members: Keith Davidson, Charles Fairchild, Bill Lenz, Carl Peterson and Haskell Sheinberg.

In recent months, this CMB-6 section has been especially effective in formulating and fabricating metal mixtures for LASL reactor activities. One accomplishment in particular illustrates the section's work. This feat was performed at the bidding of the Laboratory's Phoebus Project

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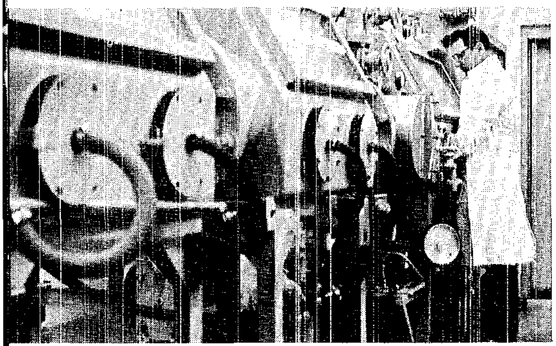
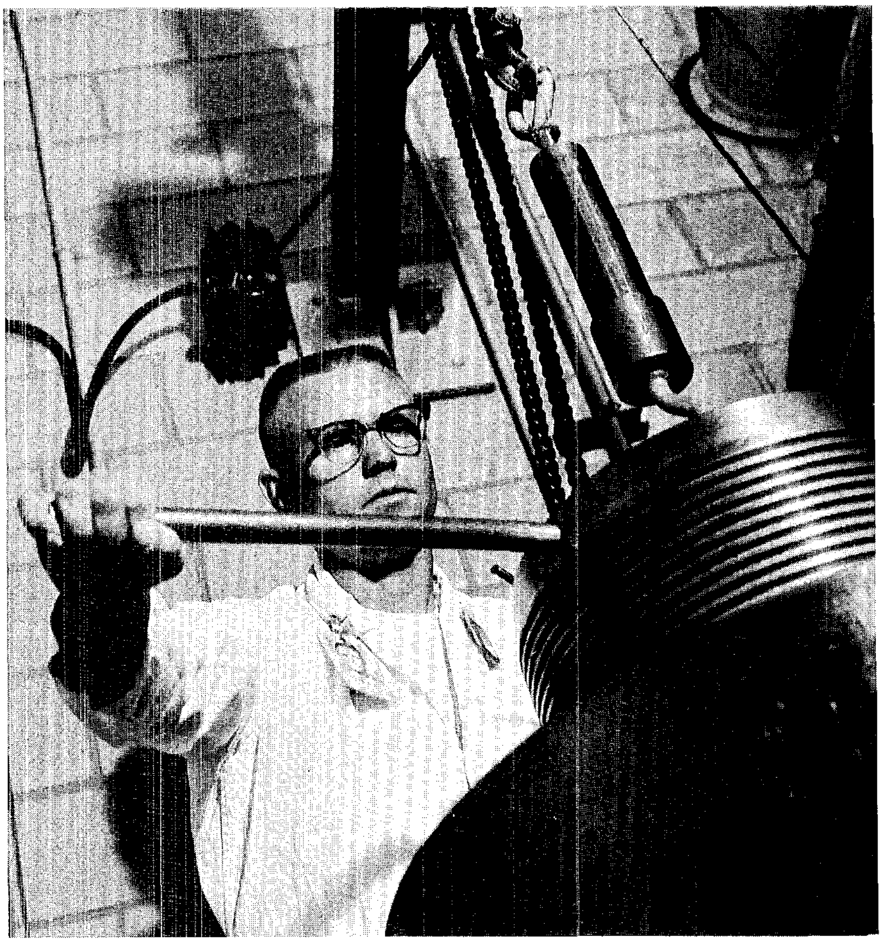
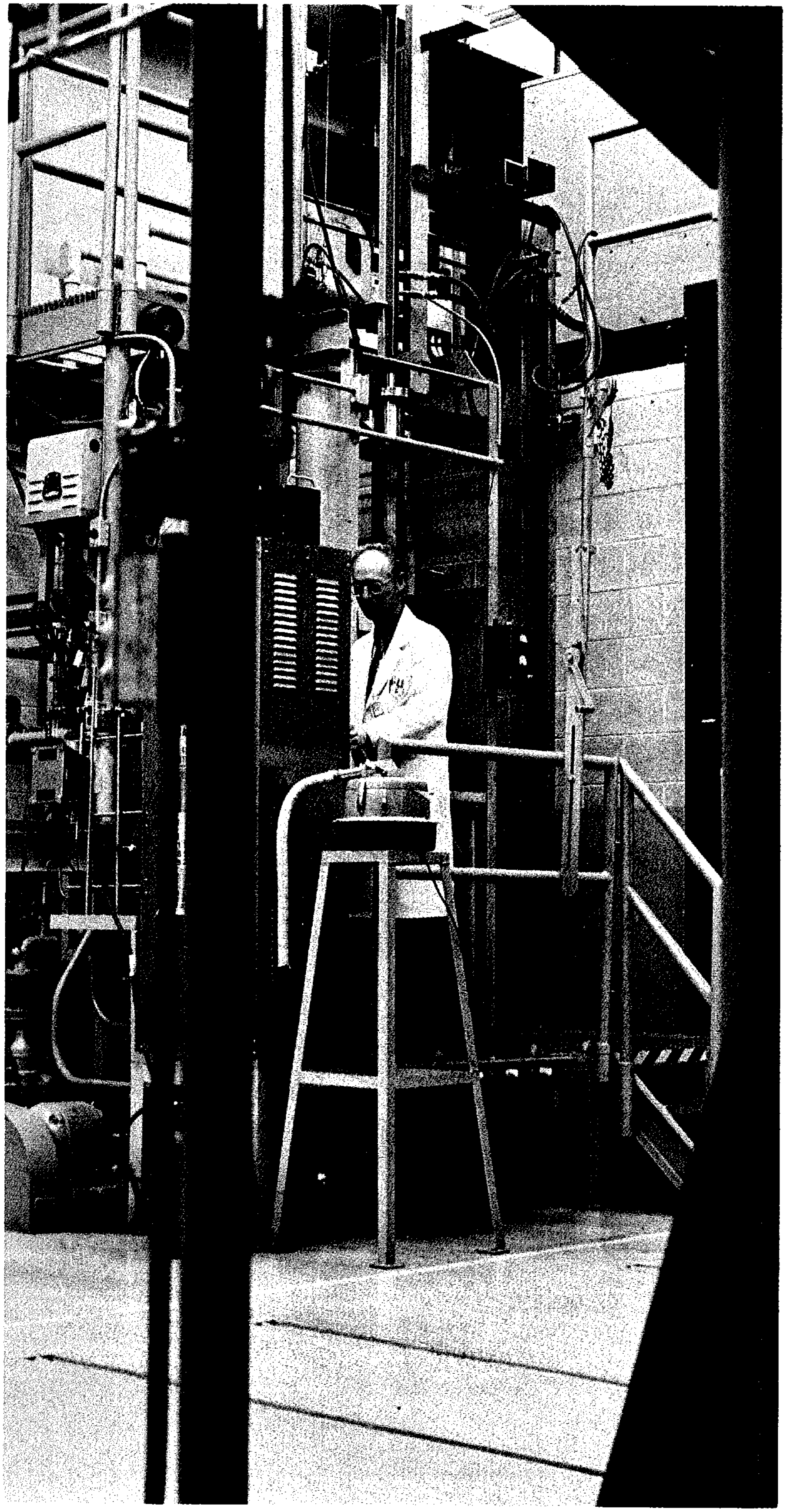


John Kostacopoulos crushes and blends powders, makes pressings in the argon atmosphere of air-tight dry boxes.

Temperatures, which reach 3,200°C, within this vacuum hot press are read by optical means by John Magnuson.

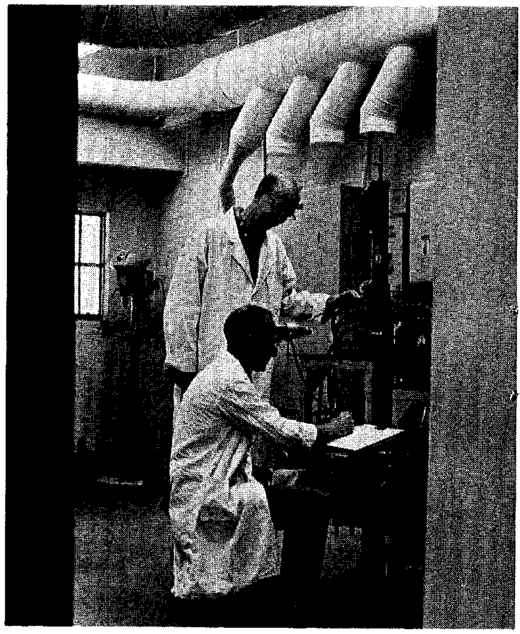
This massy plug, screwed into place by Harold Davis, can withstand 50,000 p.s.i. Cylinder has six-inch steel walls, is part of highly shielded isostatic press.





At heart of this welter of equipment (left) are two arc furnaces, used to combine recalcitrant materials. Devices, which work on principle similar to electric arc welders, are operated by Barry L. Barthell.

High temperature test furnace (below) was designed and built by Power Metallurgy section. Technician Bud Richerson is at the controls. Bill Lenz, staff member, is the observer.



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personnel, who are involved in designing advanced nuclear rocket reactors.

The reactor people have long been interested in economies in and improved composition of the vital reactor control plates. These components bar a nuclear reaction by absorbing neutrons when inserted into the reactor core or permit a reaction when they are withdrawn.

Boron is an excellent neutron absorber. Thus the reactor program has been using plates composed of a boron isotope, B^{10}, and aluminum. But the combination has its drawbacks, including the high costs of B^{10} and the cantankerousness of the finished product, which is discouragingly brittle. Even so, fabrication of the two elements was considered an accomplishment—but one on which to improve.

It was suggested that in place of B^{10} a mixture of boron carbide and copper be used. "Copper doesn't react with boron as aluminum does to form a brittle substance," Riley explains, "and copper is more ductile and retains its ductility. If this idea could be made to work, the significant thing would be the use of normal boron carbide, which is relatively cheap and available in large qualities. And because of the high melting point of copper (as compared with aluminum), the temperatures at which the control plates can operate can be extended."

Experiments were begun. The immediate quest was for a suitable combination of copper and boron carbide. Various formulas, working up to and including a half-and-half mixture, were tested and bottlenecks eliminated.

One of these concerned sharp corners on the powder particles that prevented the pressing of a uniform mixture. This exigency was solved with the aid of Don Hull of CMB-7's engineering group who developed an argon plasma device that produces spherical particles. With this cumbrance removed, Riley and Company found the boron carbide-copper formula to be extremely promising. The final stage of experimentation then followed, resulting in the selection of the hot press method, as opposed to the cold method, to compact the mixture into a consolidated mass.

In the process, a huge hydraulic press, one of two which sit side-by-side in a Sigma Building production area, is used. When in operation, the press is bathed in a high, ear-piercing scream, the whine of a 175-kilowatt generator. This power unit is responsible for the "hot" ingredient of the hot press technique—the power it produces goes into a 30-inch-diameter, copper-tubing induction coil that surrounds and heats the hot press die

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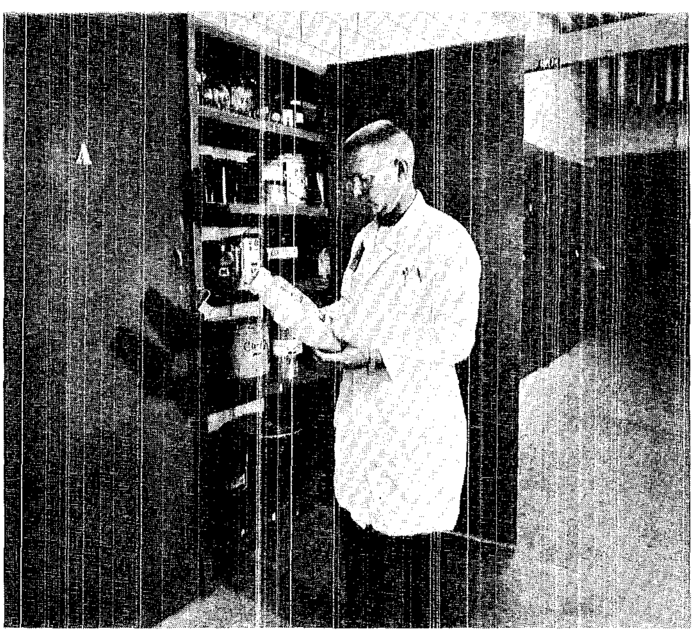
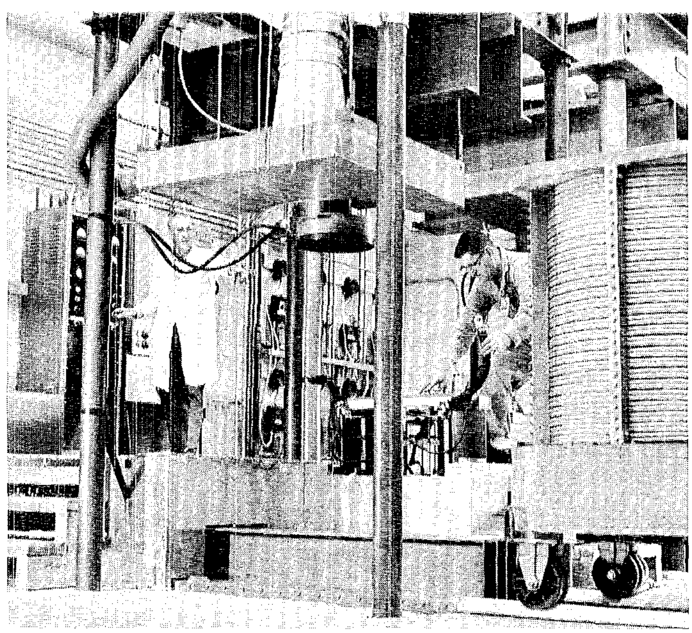
Powder Metallurgy inventory, contained in these metal cabinets, numbers 300 to 400 varieties of powders, some commercials and some made here.



Carl Peterson, left, staff member, and Ted Herrera, technician, prepare 100-ton-capacity press to receive heating coil at right. Giant ram has been raised.



Metallurgy

Continued

and piece to be fabricated. Temperatures to 2,000° C have been reached inside the pressure cauldron. In the boron carbide-copper pressing cycle, however, the level is kept below 950°. At the same time, tremendous pressures are being applied by the hydraulic ram.

On an actual run, the copper-boron carbide mixture is gently spooned into a shoe-box-sized cavity in a graphite mold. The spooning is a precaution aimed at maintaining the blend so carefully prepared during hours of machine mixing. From the filling of the mold to extracting the product, the process takes 4½ hours. The ingot is then cleaned by wire brushing and plated with copper. When finished, it is delivered to the fabrication section of CMB-6 for rolling into sheets. The control plates are subsequently fabricated from the sheets.

The value of this successful search for an improved material is readily apparent in a sensitive locale: costs. Riley says that the boron carbide mixture costs only about 20 cents for each dollar required for fabrication of aluminum and B^{10} reactor control plates like those used in the Kiwi reactor program, Phoebus' predecessor.

"This stuff is cheap enough that we don't have to worry about recovery of boron from the scrap," he says.

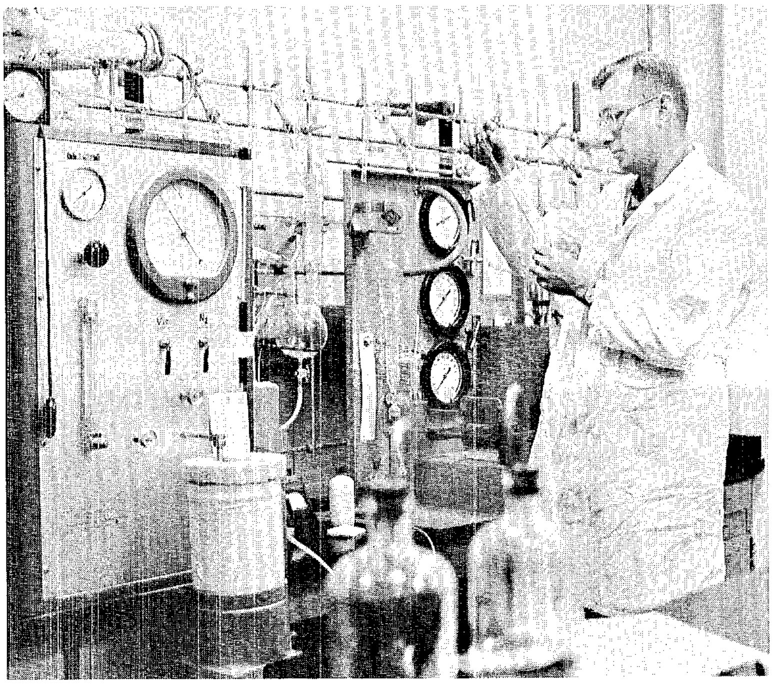
This episode is only one example, though a spectacular one, of powder metallurgy's increasing usefulness in the scientific picture. "In the last few years," reflects Riley, "powder metallurgy, not only here but everywhere, has come into its own. Here, for instance, we have extended our temperature capabilities to 3,000 degrees centigrade and higher—in a vacuum, argon, hydrogen or helium gas. In other words, we can thermally treat materials to those temperatures in any one of those atmospheres."

The powder evaluation laboratory, which Riley says "is probably second to none in the country," is used to evaluate powders for particle size, shape, density and distribution. To accomplish this, an impressive array of sizers, screens, balances and microscopes is on hand. For more specialized jobs, technicians graduate to such occultly labeled equipment as Coulter counters, Numec surface area apparatus, gas pycnometers and mercury porosimeters.

Several methods of pressing materials are used. The control plate mixture was compacted by the hot press method. The cold press method involves two main processes—hydrostatic pressing and pressing in steel dies. With the former, the materials are placed in a plastic bag that, in turn, is submerged in an oil bath. The bath, held in a cylinder with six-inch high-strength-steel walls, can be pressurized to 50,000 pounds per square inch. The steel die method is similar to the hot press process, but without the heat. Following the pressing, however, the product is frequently heated to a set temperature and held in an inert gas atmosphere for a given time. This phase, calling sintering, results in diffusion of the metal particles and adds to mechanical strength. In addition to these techniques, the powder metallurgist also uses the methods of extrusion and button and vacuum arc melting.

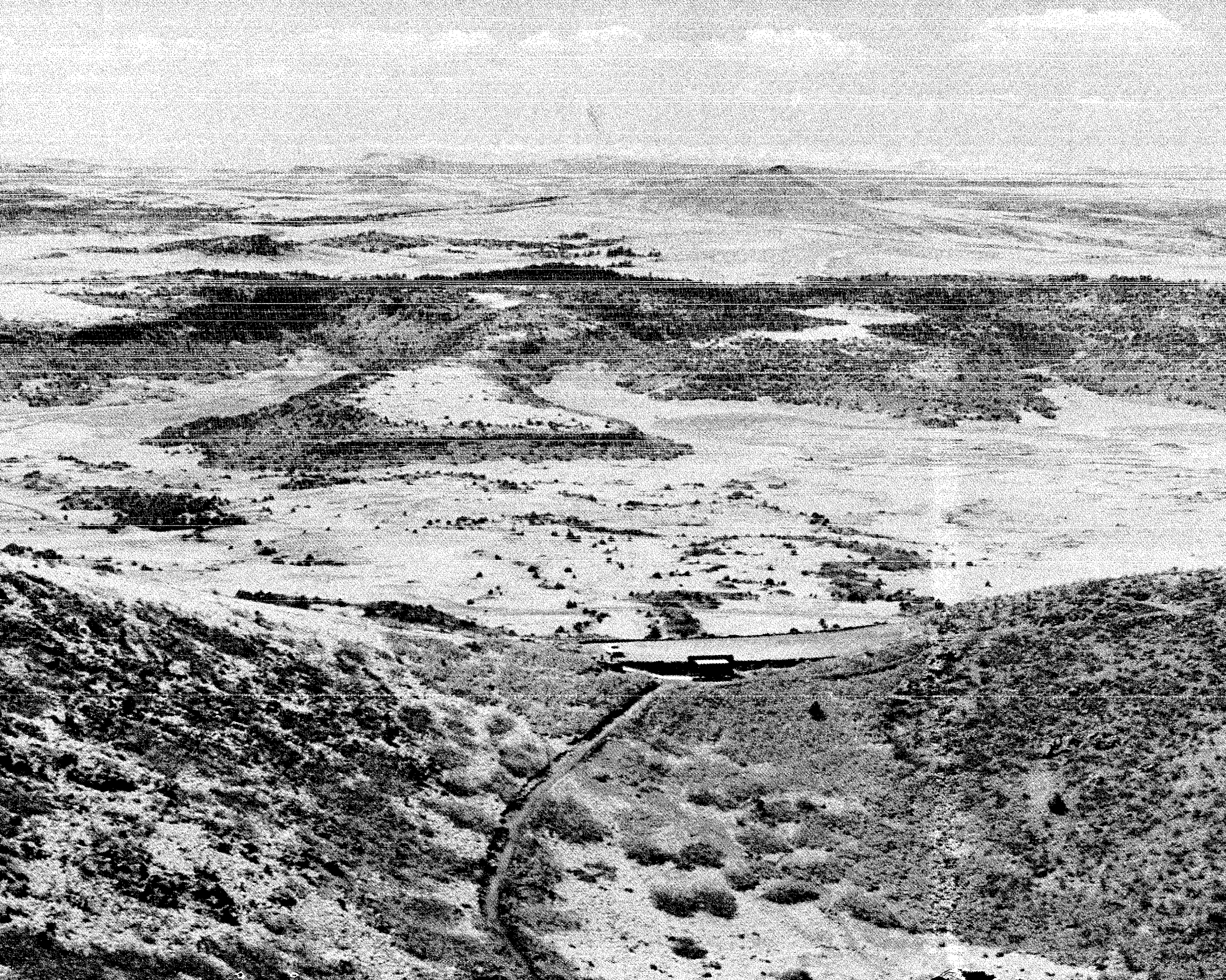
The section maintains a large inventory of powders. Some were purchased from commercial suppliers; others were made here. The store includes some 300 to 400 varieties, among which are elemental materials, carbides, nitrides, borides, hydrides, oxides and alloy powders. The amounts vary from two grams of a rare isotope to several tons of tungsten, nickel and iron powders. The rare isotopes may cost $200 a milligram while materials like aluminum cost as little as $2 a pound.

With their expertise in providing the right mixture for the right job from such an array of materials, this enclave in the scientific community is getting away from the old image as strictly a support group. In the proliferation of ultra-specialized investigation and research, even the tools and materials used in stretching the borders of scientific knowledge have, in many instances, become a science in themselves. Powder metallurgy is one of those instances.

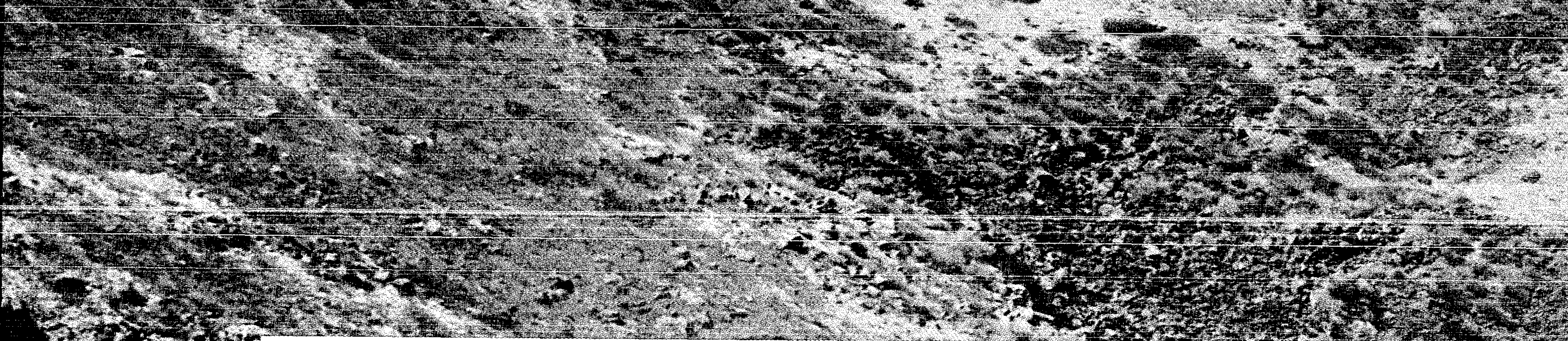


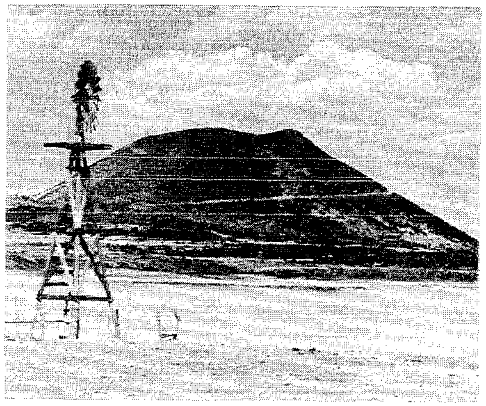
With mercury porosimeter and surface area analyzer, John Pritchard, a technician, analyzes powders.

Section Leader Robert Riley, left, and Keith Davidson, staff member, study photomicrographs of mixtures being attempted.



capulin mountain



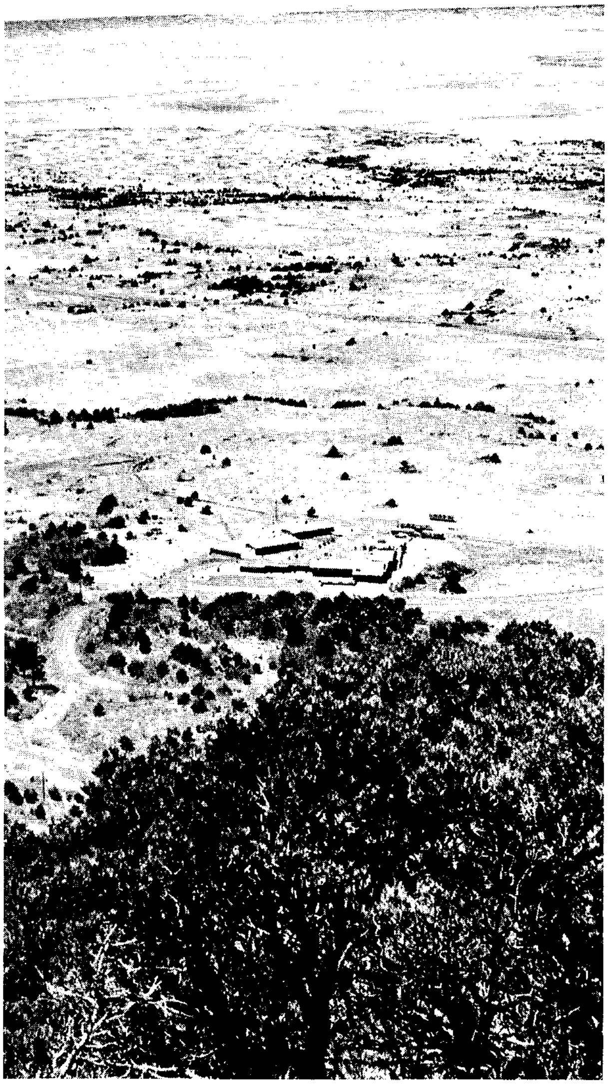


THOUGHT I saw Capulin's sagging west lip from 40 miles away—in a glimpse through the butte-slashed country south and west of Raton.

But I couldn't be sure. The volcanic vestiges that poke up through the grassy floor east of Raton are scattered, randomly, like massive pawns in a forgotten game of primordial chess.

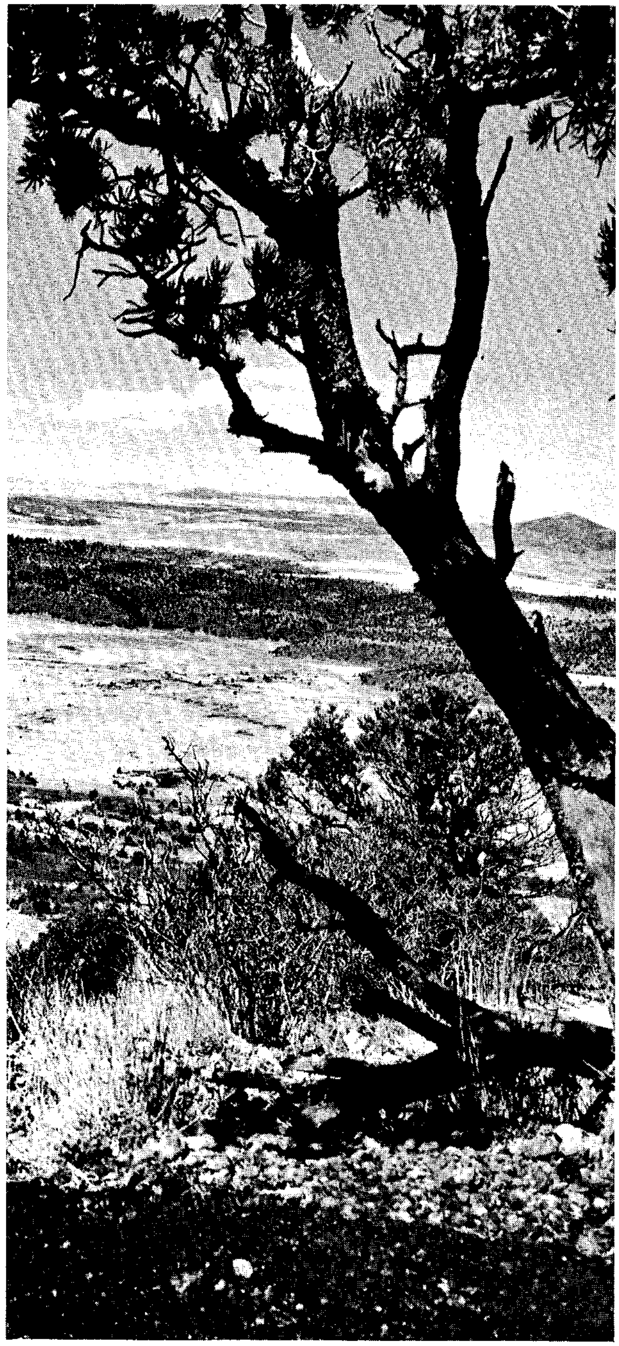
The region is mostly range country. Cattle, slow of foot and mind, peppered the amber pastures a few weeks ago when I made my one-day trip into this northeast- / *continued*

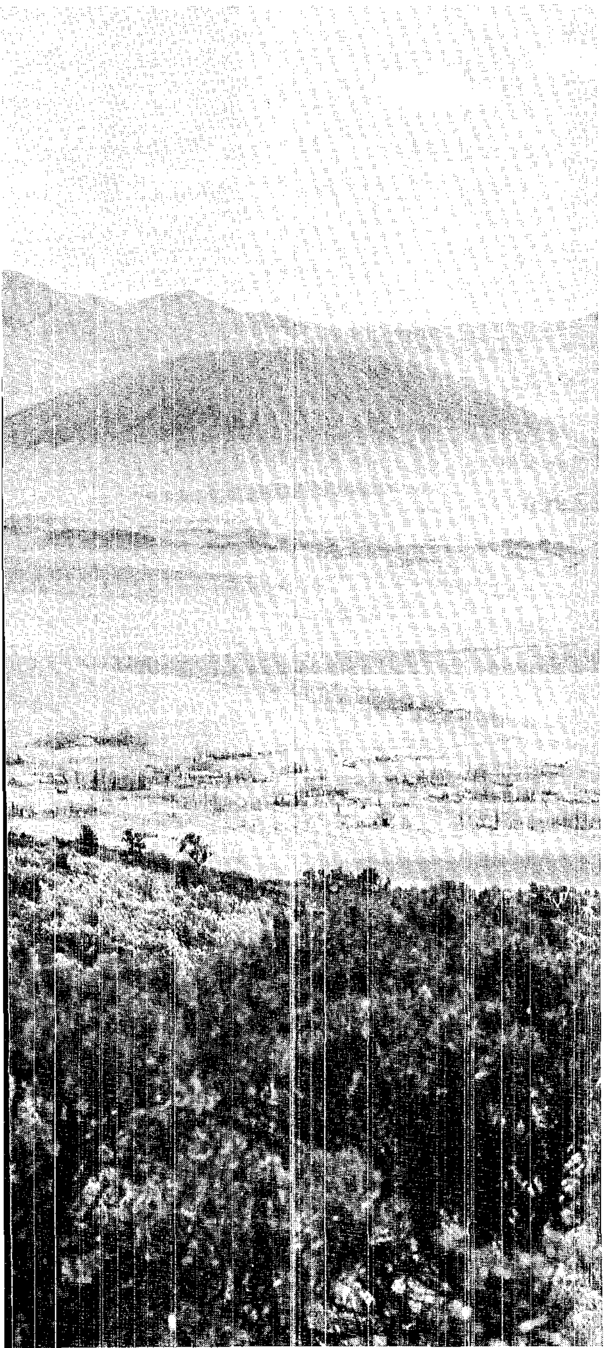
This view looks across Capulin crater from 415 feet above crater floor. Parking lot, upper center, is on western rim.



Monument headquarters, completed three years ago, floats on sea-like pastures that surround Capulin. Bushes dot lava flows beyond.

A few tufts of white, billowy clouds approach from west to flavor this vista, seen from cinder trail around crater rim. View looks toward west.





Volcanic cone visible behind town of Capulin is one of several sisters to monument peak. Most mountains in area had volcanic origins.

capulin

Continued

ern corner of New Mexico. A cowboy rode fence beside U.S. Highway 64 between Raton and Cimarron. Ranch houses dotted the landscape, providing nucleuses for surrounding fence rows.

I left Los Alamos early. For one thing, I was chary of a highway map that, too glibly, I thought, indicated the route between Taos and Raton was more or less straight, capable of supporting driving speeds that propel you one mile in one minute.

The doubt was well-founded, as anyone who plans to make the Capulin trip would do well to make note. For a good 70 miles, U.S. 64 buckles and backtracks like a seismograph needle during a strong earth tremor. But at 25 miles an hour, you see more, and there's plenty to see in the mountain country around Eagle Nest and Cimarron Canyon and Ute Park.

Slowed as I was by this obstacle course bearing a U.S. Highway designation, it was approaching noon when I spotted, and knew that I had spotted, Capulin Mountain. It sits off in a dimensionless pasture and is seen as a smooth, contoured, stippled shape looming in a sea where windmills serve as buoys.

Capulin Mountain is an extinct volcano. Its symmetrical design, almost perfect, makes it appear that this cinder-and-ash cone is the handiwork of a meticulous craftsman. Instead, the mountain is the aftermath of a violent venting of the earth an estimated 7,000 years ago. That seems like a long time. But as geologists measure time, Capulin is a mere adolescent.

The approach to the mountain is made via U.S. 64-87 east from Raton. Twenty-nine miles out, at Capulin, a wisp of a community that changed its name when the cone was made a national monument in 1916, State Road 325 leads north. The monument entrance is three miles from town, but driving times vary. They are directly tied to the number of bovines congregated about the two cattle guards en route.

I had fortuitously picked a clear day, give or take a few billowy dabs of clouds wafting in from the west.

According to the brochure provided by the National Park Service in Santa Fe, this should mean that a 360-degree panorama awaited me, one that goes on and on and on. I was anxious to get my camera in action before the shadows in the crater leaned too far eastward. So I momentarily bypassed the visitor center and headed for the top.

As the parking lot came into view, I could see that there was no one else on the rim. Later, a secretary, one of Capulin's four permanent employes, told me that most of the monument's 65,000 or so visitors come during the

Continued

summer months. I was early. I had the whole mountain to myself.

During the last few days, I had read several articles about Capulin, the brush-covered cinder cone with the view into five states. I knew that Capulin rises more a thousand feet above the plains. I knew that the Sangre de Cristo Mountains, still snow-capped, could be seen to the west. And that on a clear day, the western half of Colorado's twin, towering Spanish Peaks, near Trinidad, was visible, along with a brace of lesser mountains.

Still, I wasn't prepared.

First, it was the wind. It was just a ripple, like a feather, against my face. But over beyond the precipice, out there cascading over hillocks, through canyons, and across the plains, it could be heard to move. Unrelentingly. Unceasingly. A steady, comforting, obvious but unobtrusive sound.

With this sensation acutely present, I focused my attention on the scene to the west. There on the horizon were the Sangres, hoary, massive, dominating. They looked bigger than life. Yet for all their commanding presence, they were upstaged by the utter vastness in which they sat.

Distance and size lose their perspective on Capulin Mountain. A bush far below looks larger than it should, although the world of which it is a part unfolds as a Lilliputian model.

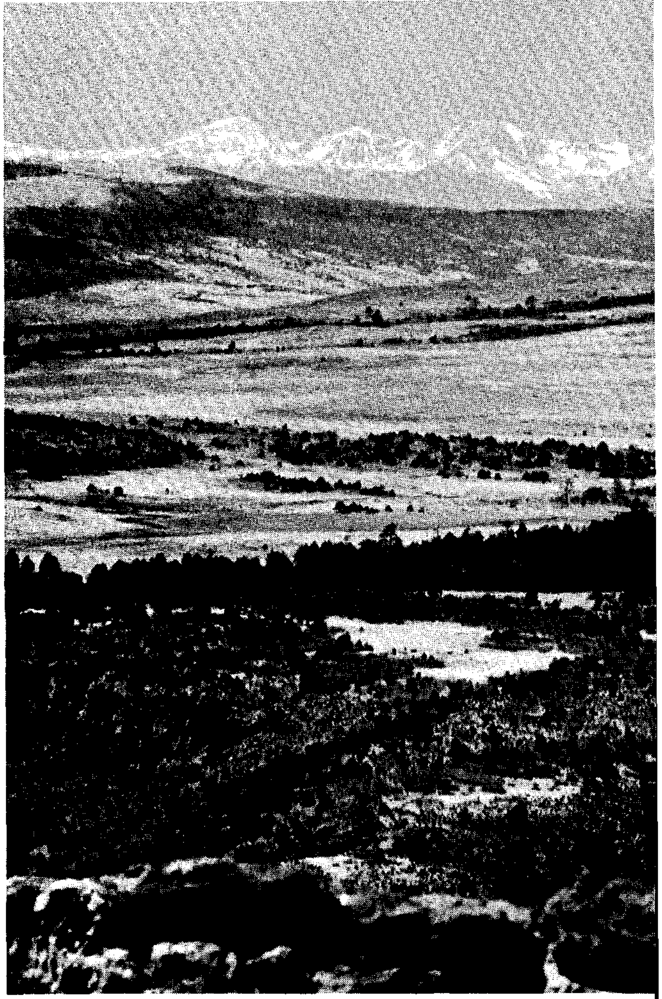
This miniaturization on a massive scale continues within Capulin itself. The crater, now sealed by a plug of lava that has long since hardened and cracked into a field of boulders, plunges to a low of 415 feet below the highest point of the rim. From the parking lot, the distance to the crater floor is a lesser 100 feet. A trail winds to the bottom.

To best grasp the colossus, both inner and outer, that is Capulin's vantage point, it is necessary to take the one-mile hike around the crater rim.

I shouldered a tripod and crammed lenses in both pockets and moved out. The path is a cinder affair; it begins to climb immediately. The ascent is 315 feet, and so's the descent, and the Park Service advises that you take an hour for the trip.

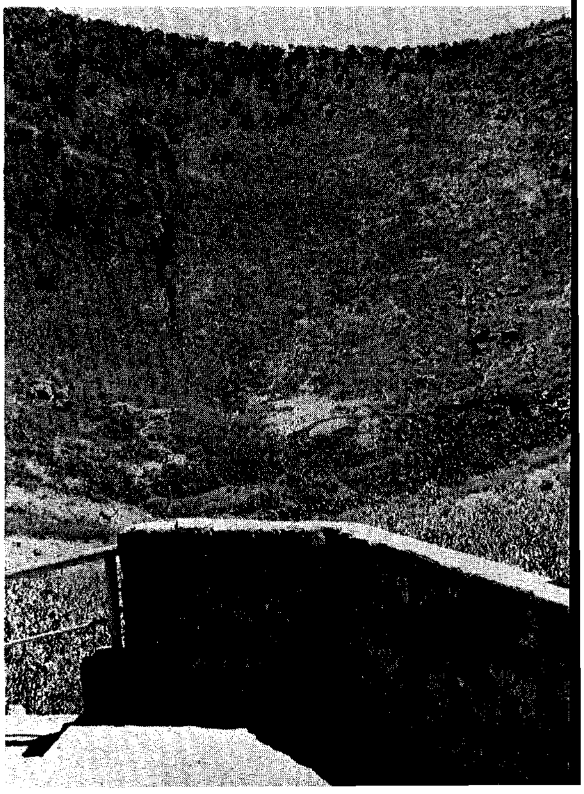
As you proceed, this part of the world slowly passes in review, as if you were suspended a fourth of a mile high in the revolving gondola of a balloon.

The town of Capulin, seemingly without movement, nestles to the south. Beyond, the checkerboard markings of old croplands, abandoned in the drouths of the '30s, interrupt the pattern of the prairie. A few more degrees around the cinder path and Sierra Grande Mountain moves into focus. At the foot of this million-year-old peak is the little community of Des Moines, a pinprick of real estate.



Snow-capped Sangre de Cristo

Walkway leads from this landing to bottom of Capulin crater, seen near center of photograph near marker.



Mountains form hoary fringe on western horizon.

Farther on, a red-and-black scar, evidence of a mining operation, in an adjacent cinder cone is pointed out by the instructional pamphlet provided by the Park Service. And at numerous other stops, the flora that has taken root on the acidic slopes of Capulin is described.

Just before the steep but welcome decline is encountered on the trail, the booklet calls attention to Capulin's five-state view to the northeast.

Actually, you look in vain for the oilwells of Oklahoma and the wheat fields of Kansas. But with a little imagination, you can suspect that these two states are lurking on the horizon just beyond the limits of your eyesight. Moreover, just behind Rabbit Ears Mountain, near Clayton, N.M., awaits the Texas Panhandle. But it too is an illusive sight.

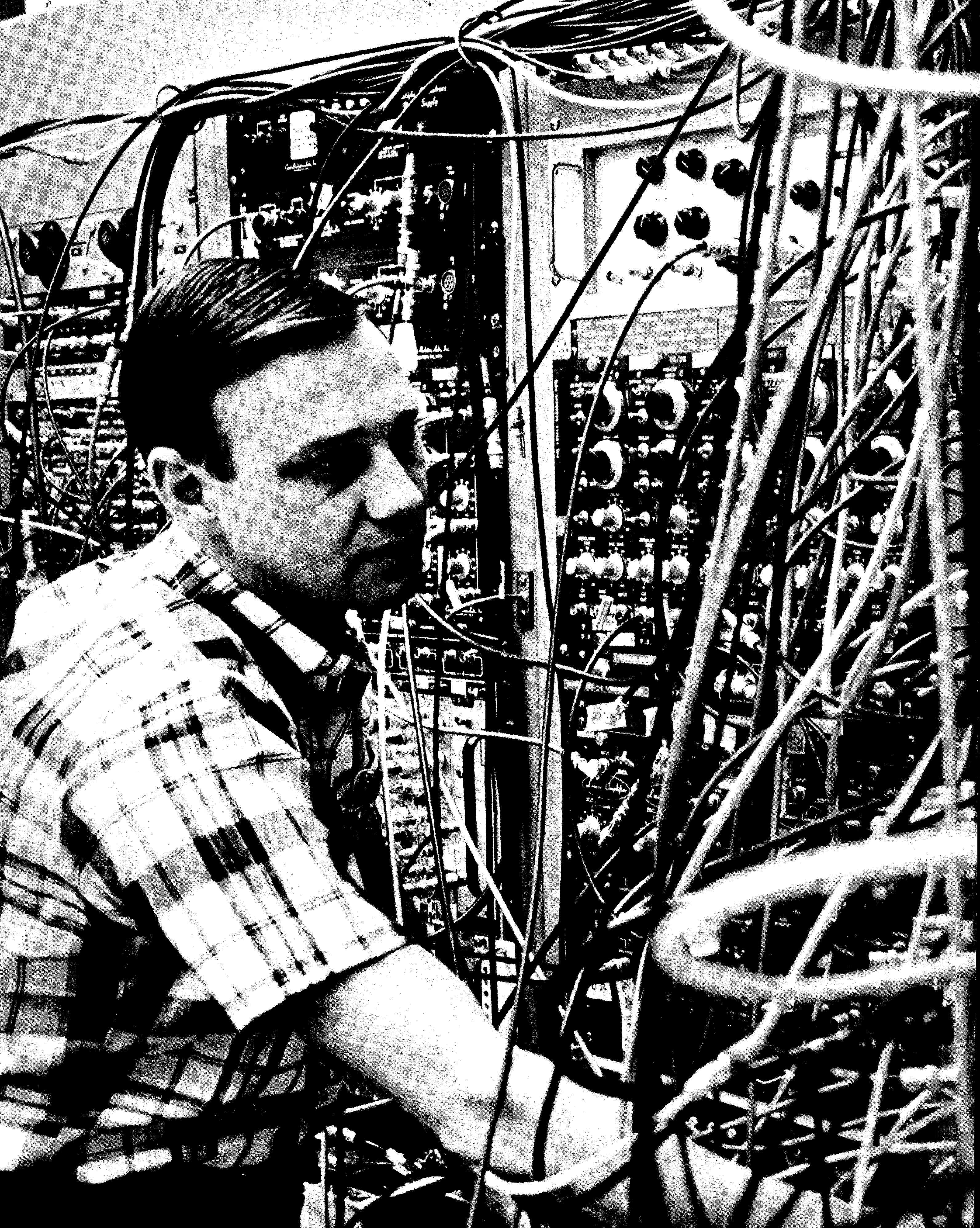
The views of the other two states, Colorado and New Mexico, however, raise no doubts.

This phenomenon duly noted, I started down, winded but captivated. The view past Rabbit Ears Mountain settled a little more with each step down the cinder path, but I knew that the spell of Capulin Mountain would linger for a long time.—D.L.

Capulin Mountain's visitor center, completed three years ago, is most attractive.

A park ranger is on duty from 8 a.m. to 5 p.m. daily. Explanations of Capulin's explosive origin and other facets of volcanic life are available. Among the aids offered is an audiovisual program that illustrates the striking power of volcanic eruptions.

Restrooms and water are available at the monument picnic area. There are no campgrounds.



A Tryout For Liquid Tritium

highly radioactive isotope of hydrogen is being used to probe the binding forces of the nucleus.

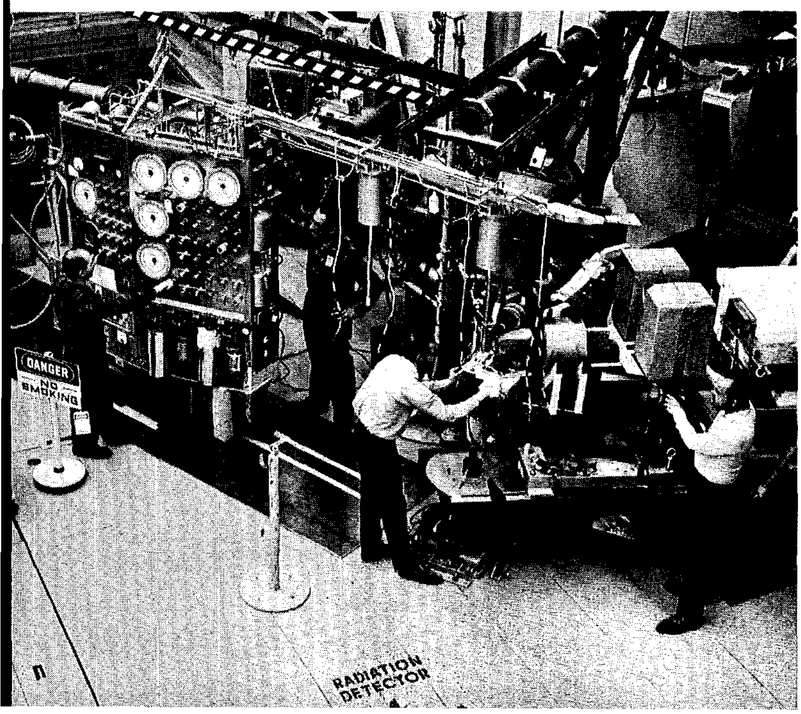
LTHOUGH physicists have long known that the nucleus of an atom consists of protons and neutrons, they still do not understand in detail how these particles interact with each other within the nucleus. Why, for example, should neutrons, which are neutral particles, stay tightly bound together only within a nucleus?

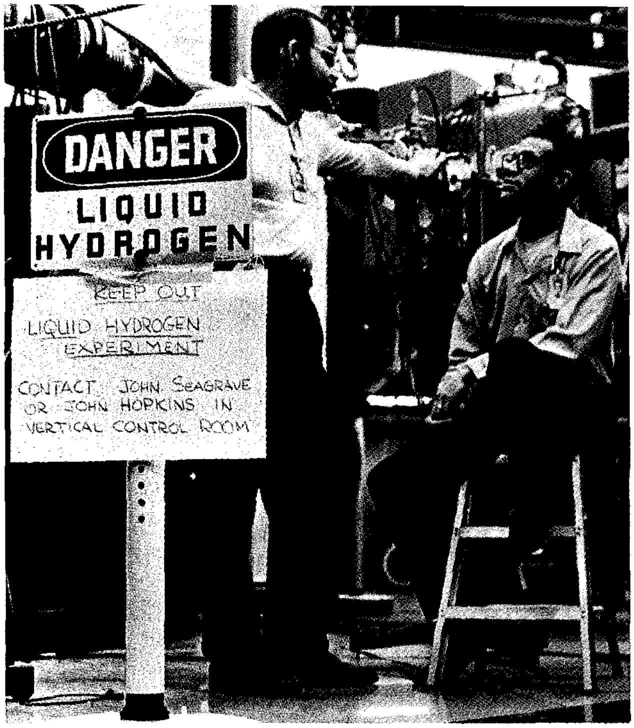
To gain insight into the character of nuclear binding forces, three Laboratory staff members, John Seagrave, John Hopkins, and P. W. Keaton, all of P-DOR, are investigating the interactions of energetic neutrons with samples of liquid deuterium and liquid tritium.

Deuterium is an isotope of hydrogen that has a neutron as well as a proton within its nucleus. Tritium, also a hydrogen isotope, has two neutrons in its nucleus. The tritium measurements are the first nuclear physics experiments ever undertaken with a liquid sample of this highly radioactive substance.

The interactions that are the basis of this experiment have substantial practical applications as well as a significant basic physics value. Any interaction of deuterium and tritium with fast (energetic) neutrons is of interest to the designer of thermonuclear weapons and power sources. For within any thermonuclear reaction, vast numbers of fast neutrons are released. The manner in which these neutrons react with the deuterium and tritium "fuel" during the early stages of the detonation affects the efficiency of the weapon.

The combination at Los Alamos of years of cryogenic experience and an excellent facility for producing short, intense bursts of fast neutrons is essential to the success of these studies. Hopkins



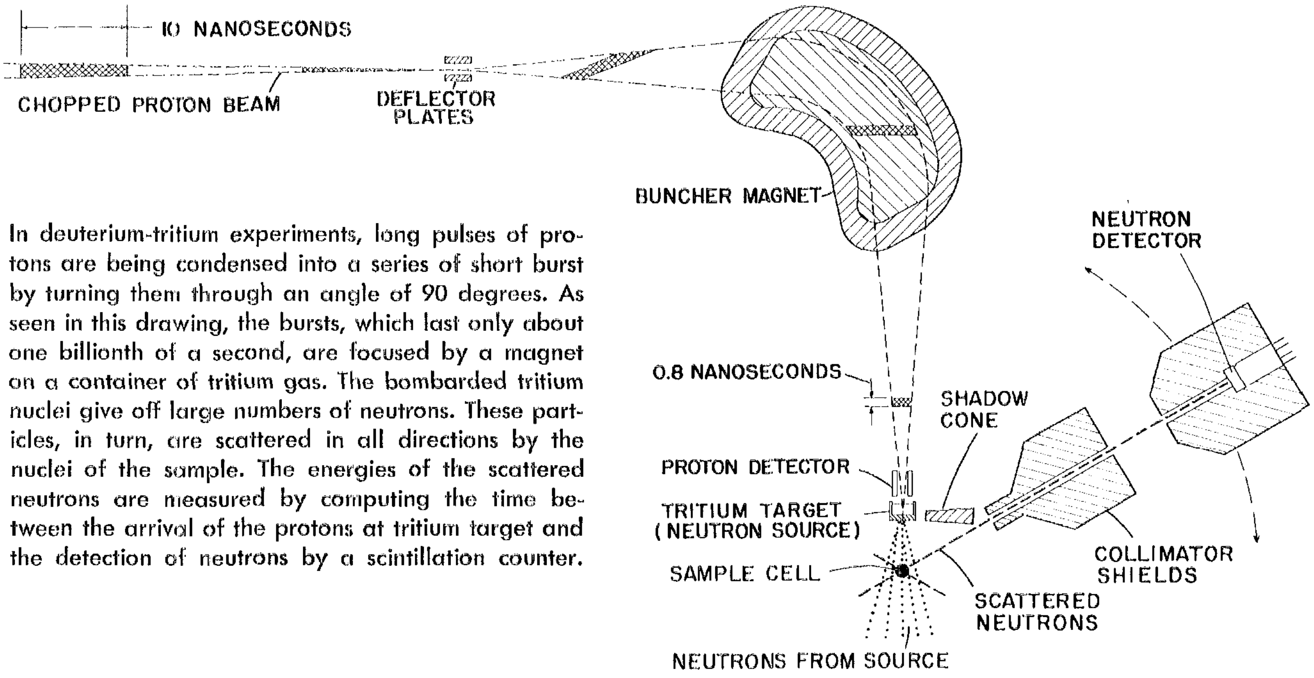


Sign in front of John Seagrave (left) and John Hopkins, two of the experiment's three initiators, warns outsiders.

puts it succinctly when he says, "There are very few laboratories in the world where these measurements could be made. LASL is one of them."

Neutron interactions with very light nuclei (hydrogen and helium isotopes) have been studied since the late 1930s, but only in the last few years has it been possible to make sufficiently accurate measurements of neutron energies for the study of such interactions. The problems have been twofold: producing very short pulses of fast, monoenergetic neutrons (neutrons whose velocities and hence energies are uniform), and accurately sorting out the neutrons after interaction with a sample.

Fast neutrons involved in these experiments can have energies ranging from about one to 24 million electron volts (MeV). A neutron with an energy of 24 MeV is moving at nearly one-quarter the speed of light and takes about four billionths of a second to travel one foot. Less energetic neutrons take more time to travel the same distance.



In deuterium-tritium experiments, long pulses of protons are being condensed into a series of short burst by turning them through an angle of 90 degrees. As seen in this drawing, the bursts, which last only about one billionth of a second, are focused by a magnet on a container of tritium gas. The bombarded tritium nuclei give off large numbers of neutrons. These particles, in turn, are scattered in all directions by the nuclei of the sample. The energies of the scattered neutrons are measured by computing the time between the arrival of the protons at tritium target and the detection of neutrons by a scintillation counter.

To measure the velocity of such energetic neutrons to an accuracy of a few per cent requires that they travel 10 feet or more from sample to detector and that techniques for producing and detecting neutrons in less than one billionth of a second be used. Seagrave describes this tiny unit of time, a "nanosecond," as a "light-foot" because it is the time light takes to travel one foot. Nanoseconds have become the new unit of time reckoning in nuclear electronics, largely superseding the 1,000-fold larger "microsecond" in vogue a few years ago.

To be practical, any apparatus for measuring the time interval between production and detection must be able to make many thousand measurements each second. The actual instrumentation for making such measurements is involved and complex—a maze of equipment connected by literally miles of cable.

The sequence of events during a typical measurement of neutron and deuterium or tritium interactions is as follows: A proton or deuteron beam from the Los Alamos Vertical Van de Graaff accelerator is divided into a series of long pulses. These pulses are then deflected through a large electromagnet, shaped somewhat like a racetrack, that "bunches" each long pulse into a much shorter one. The short pulses are then focused on a tritium target with which they react almost instantaneously, producing bursts of fast neutrons. Some of these particles interact with the liquid deuterium or tritium sample placed close by. In the meantime, an electronic detector has recorded the arrival of the protons or deutrons at the tritium target and hence the time a neutron burst is produced.

Neutrons scattered from the sample are detected by a scintillation counter which can be rotated at various angles in relation to the scattering sample and neutron source. This scintillation counter is buried in a massive collimator: a device which assures that the neutrons reach the scintillation counter in a narrow parallel beam. The energy of the scattered neutrons is measured by computing the time interval between the arrival of the protons at the tritium target and the neutrons at the scintillation counter.

By knowing the energies of the neutrons produced at the tritium target, and computing the energies of the neutrons observed at various angles, much can be learned about the probabili-

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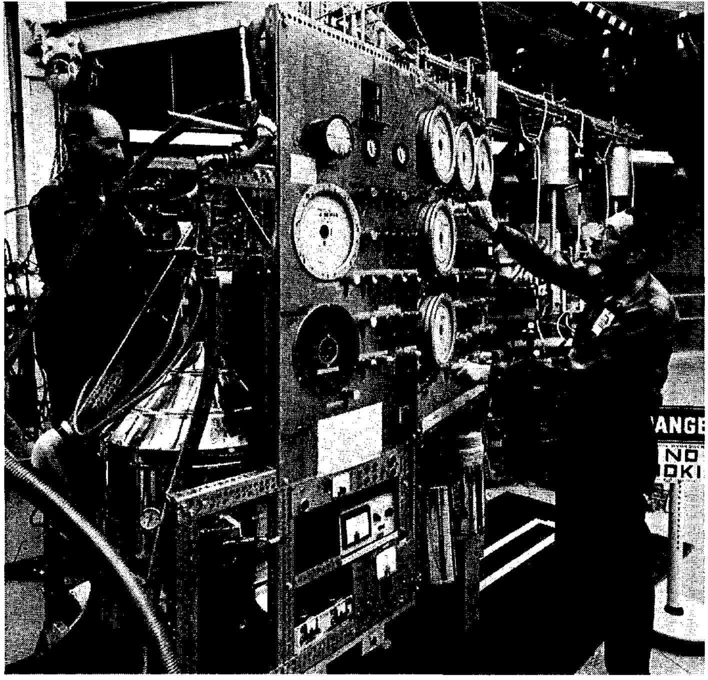


Sherman (left) and Kerr, in this close-up view, adjust valves on complicated apparatus that is employed to control the gases used during interaction measurements.

Tritium

Continued

ties of occurrence of the various interactions and thus, indirectly, about the nuclear binding forces in these samples.

The tritium scattering sample which will be used by the LASL researchers is unique. It is the only liquid sample of this isotope employed for the study of neutron interactions.

A primary reason for using liquid tritium is that it provides the densest possible sample (and thus increases the likelihood of interactions) that can be used for neutron scattering. A slushy sample of frozen tritium might be a little denser, but is unacceptable because of handling and safety difficulties. Also if frozen tritium were used, the radioactive decay of tritium into gaseous helium would present containment problems in the cell holding the sample.

Tritium boils at -416°F at Los Alamos altitude, and the six-gram sample emits nearly two watts of heat due to radiation alone (similar to a three-cell-flashlight bulb). Moreover, to provide a satisfactory neutron-scattering sample, the containing cell must be of lightest possible construction, and, to avoid unwanted neutron interactions, must not be surrounded by light nuclear materials such as hydrogen. Since liquid hydrogen is the only plausible refrigerant (liquid helium is ruled out because it would freeze the sample), a number of difficulties are created.

However, to quote Seagrave, "From our long history of collaboration with the Cryogenics Group (CMF-9) in preparing samples suitable for nuclear physics experiments, we were confident that they would come up with a safe system and a good one."

Indeed, they have. Gene Kerr and Bob Sherman of CMF-9 designed a pair of cryostats specifically for this experiment. A cryostat keeps a sample at a constant low temperature. These particular ones make use of the fact that liquid hydrogen is a few degrees colder than either liquid deuterium or liquid tritium and hence can be used to liquefy these two gases.

Gaseous tritium enters the scattering cell through a tube surrounded by a thin "jacket" of liquid hydrogen. It condenses within the tube and drops into the cell which is about one inch in diameter and 1½ inches long. Both the cell and the tubular jacket of liquid hydrogen are surrounded by an evacuated sleeve which serves as an excellent insulator. The walls of the cell are only three thousandths of an inch thick, about the thickness of ordinary typing paper, while the walls of the vacuum sleeve at the tip around the cell are four thousandths of an inch thick. The delicateness of the walls is aimed, again, at reducing competing neutron interactions.

Although the system contains a very large amount of tritium, it has important safety features which preclude the release of this highly radioactive substance into the surrounding area.

Thus far, measurements have been made only with liquid deuterium. Additional deuterium runs and the tritium studies will be made during the summer and fall.—Ed Walterscheid.

17 Years at the Controls

by Barbara Storms

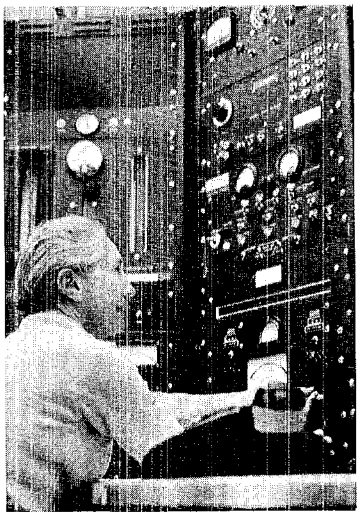
"I like everything about it. I want to work down in Omega Canyon until the very day I have to retire."

So spoke Reactor Operator Jane Heydorn in an interview with the LASL News in 1960, and now, as that day nears, the little lady of Omega Site is doing just that and is as enthusiastic about her job as ever.

Mrs. Heydorn's retirement on June 30 will end 17 years of reactor operation that began in 1949 when she became the first operator of the historic Clementine, the first fast reactor using plutonium, and probably the first woman in the world to hold such a job.

When the plutonium-fueled reactor was retired in 1952, Jane switched to the Water Boiler.

Operating nuclear reactors seems an unlikely job to fall to a petite, freckle-faced young immigrant who first saw the United States from Ellis Island in the heat of August in 1920. Jane had come from her birthplace in Ennistymon, Ireland, to join her sister in New York where she would later work as a telephone operator. After sampling the stifling heat and the frantic subway rush that first day, Jane recalls, "I would have given the whole world to be back in Ireland."



Jane Heydorn

But when she arrived in Los Alamos 24 years later her reaction was much different.

"I loved Los Alamos the day I saw it and I'm just as happy now as I was then," says Mrs. Heydorn in her gentle, brogue-touched voice.

Happy though she was, she also was surprised. Jane had enlisted as a WAC in New York in 1943, gone to Florida for training in communications and taken what she assumed to be an overseas assignment. Instead, after a long and closely-guarded train trip, she found herself and her fellow WACs disembarking at Lamy early one cold January morning and riding by bus to what seemed the middle of nowhere.

"When we finally stopped down where the Y is now," she recalls, "someone asked 'why' and the officer told us, 'This is where you get your parachutes.' "

There was a long wait at the bottom of the hill while passes were being checked and by the time they arrived at the top of the plateau, the sun was up. "I'll never forget it," says Mrs. Heydorn. "It had been snowing but the sun had come out and the sky was bright blue. I had never seen anything like it."

Bursting with enthusiasm for her new home, Jane was disappointed to learn she couldn't tell anyone about it. "I wrote to one of my relatives about the snow, the blue sky and the sunshine and the censors sent the letter back asking me to rewrite it and leave out the description." Project secrecy prohibit-/*continued*

ed any mention of details that might offer a clue to the location.

The only thing Jane remembers disliking about Los Alamos was the mud. "Our shoes were always muddy when we had to fall out for inspection."

For years Jane continued to enjoy the country by walking the three miles to work every day from her 39th street apartment. "I love to walk," she says, "I don't even own a car."

M/Sgt Heydorn began her assignment at Los Alamos as a telephone operator for Army intelligence but transferred a year later to the Laboratory's electronics group where she learned electronics construction. After her discharge in 1946 she returned to the same work as a civilian.

In 1949 she was selected for the reactor job in Omega Canyon.

"They told me if I had enough patience for all that electronics work, I was bound to be good at running a reactor," she says. She learned later that much of her work in electronics had been construction of parts for Clementine.

"When I went down to look at the reactor I didn't want to take the job," she says. "Bells were ringing, lights were going off and on. I just knew I couldn't do it."

The necessary encouragement and training came from Jane Hall, now assistant Laboratory director, and her husband, Dave, now K Division leader, who was the reactor group leader then. After three months instruction and a successful test, Mrs. Heydorn says, "Jane gave me the key to the control console and said, 'Now it's all yours. Take good care of it.' "

'When I went down to look at the reactor I didn't want to take the job... I just knew I couldn't do it.'

Her precious charge was Clementine, which served as an experimental facility until Christmas Eve of 1952 when evidence of a ruptured fuel rod indicated the end had come. It was 8:20 a.m. on December 24 and Jane was at the controls for the final run.

With the demise of Clementine, work doubled on Omega Site's other reactor, the Water Boiler, and Jane went over to operate the 4 p.m. to midnight shift.

"The Water Boiler was much simpler to operate because it wasn't all manually controlled. With Clementine I needed two hands all the time. With the Water Boiler I still have to stay and watch it but I can move around a little."

In Mrs. Heydorn's 17 years, neither reactor offered any trouble. Many built-in safety precautions and thorough operator training eliminate any problems, Mrs. Heydorn says, "and you just don't make mistakes with a reactor."

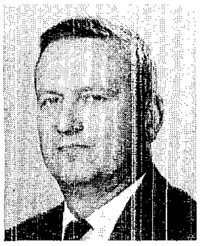
Although she knows how the reactor works probably better than anyone, can run through a check list of procedures almost as thick as a dictionary and make power calculations with ease, she insists on giving all the credit for her success to "all those wonderful people I work with." She mentions with particular affection Jane and Dave Hall, Ed Jurney and John Yarnell of P-2. "Any job I have done I have learned right here from these people."

Looking back over her 17 years, Mrs. Heydorn says "I wouldn't trade this experience for the whole world. To think that they'll take a foreigner and give you a chance to work in a place like this."

short subjects

The late Herbert E. Ungnade, who was an organic chemist with the GMX-2 Group at his death last August, is one of two scientists, both now deceased, to whom a 1,210-page chemistry reference work just published has been dedicated. Ungnade was an abstractor and editor for the volume, "Organic Electronic Spectral Data, Volume III," published by Interscience Publishers.

Norman G. Wilson, a Laboratory staff member in K Division since 1957, was installed as chairman of the New Mexico section of the American Vacuum Society at its annual symposium, held in Albuquerque April 20-22. Wilson was program chairman for the symposium, at which 16 technical papers were presented to about 200 researchers and engineers. The American Vacuum Society was established about 12 years ago to facilitate communication among engineers and scientists working in the field of vacuum science and technology.

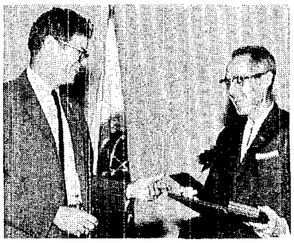


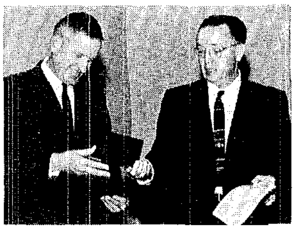
Theodore F. Harlow, 45, a staff member in the Laboratory's Weapons Division, was found dead May 2 in a car on a Los Alamos street. The coroner's verdict was that he died of a self-inflicted gunshot wound. Services were conducted at the First Methodist Church and burial was in Guaje Pines Cemetery in Los Alamos. Harlow worked in the W-3 Group. He came to Los Alamos in March of 1945 with the Corps of Engineers and joined the Laboratory in April of 1946. He received a Bachelor of Science degree in electrical engineering from Northeastern University, Boston, Mass., in 1943. Survivors include his wife, Ellen, and two sons, Thomas, 19, and Richard, 14, who live at 129 Grand Canyon Drive, White Rock.

Ralph E. Williamson, Alternate T-2 Group Leader, has been awarded the Secretary of the Navy Certificate of Commendation. The honor, announced last month, comes from Dr. Williamson's work as a member of the Polaris Ad Hoc Group for Long Range Research and Development. This group, which Williamson joined in 1961, has conducted a study of the Navy's future weapons systems needs.

Two longtime Laboratory employes in SP-4 have retired. Alberto Alarid, a truck driver, began working at Los Alamos in the dawning days of the Manhattan Project—on April 21, 1943. Cresencio Lopez hired on as a warehouse laborer in August of 1949 and retired, as did Alarid, on April 29. Lopez was a truck driver helper. Alarid lives at Santa Cruz and Lopez at Pojoaque.

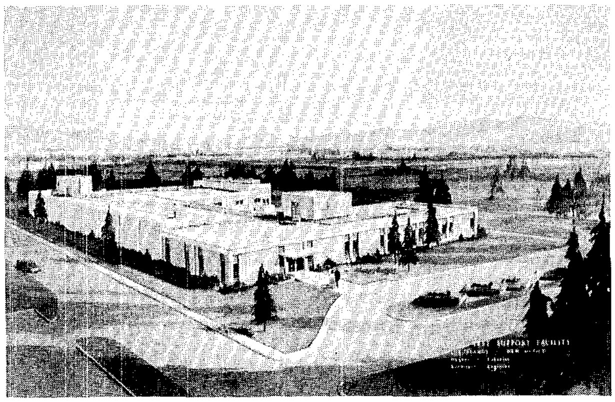
Louis Rosen, MP Division Leader, was a visiting lecturer May 9 and 10 at California State Polytechnic College, San Luis Obispo, Calif. His visit was under the auspices of the American Association of Physics Teachers and the American Institute of Physics.





Ernest C. Anderson (top, right) and Harold M. Agnew (bottom, left), LASL staff members, received the Ernest Orlando Lawrence Memorial Award April 27 in Washington ceremonies. Presenting the award to Dr. Anderson was John G. Palfrey, member of the Atomic Energy Commission. Another commissioner, James T. Ramey, made the presentation to Dr. Agnew. The two Los Alamos scientists were among five who were honored for their contributions in the field of atomic energy. Anderson is a member of the biophysics staff in H-4 and Agnew is leader of the Weapons Division.

Bids are tentatively scheduled to be opened June 14 for construction of a weapons test support facility at LASL (below). The U-shaped, single-story building will be erected on the west side of property now vacant between the Administration and CMR Buildings. The estimated cost of the 25,000-square-foot facility is $850,000 to $900,000. It will be occupied by J Division personnel. Included in the building will be shielded rooms for radioactive sources, a detector development shop, a machine shop, test areas, supporting engineering laboratories and offices for the engineering staff. The building will have a basement under two-thirds of the upper floor. Neuner & Cabaniss of Albuquerque is the architect. Bob Turner of the Laboratory's ENG-1 planning section supervised the issuance of building criteria and Harold Faire of ENG-2 will be the project engineer. Work is to be completed within 365 calendar days after the successful bidder is given permission to proceed.



Presentation at University of Wisconsin, Madison, Wisc., March 9; McMaster Toronto Seminar, University of Toronto, Canada, March 10; Chalk River Nuclear Laboratory, Chalk River, Canada, March 11:

"Three Stage van de Graaff Installations at Los Alamos" by Joseph L. McKibben, P-9.

Rio Grande Chapter Health Physicists Meeting, Santa Fe, N.M., April 2:

"Meson Physics Facility" by Harold S. Butler, MP-4.

American Chemical Society Meeting, Central New Mexico Section, College of Santa Fe, Santa Fe, N. M., April 14:

"Reflections on Ice and Snow" by Sherman W. Rabideau, CMF-2.

Twelfth Annual Highway Engineering Conference, New Mexico State University, Las Cruces, N. M., April 14-15:

"Non-Destructive Testing of Highway Materials" by Gerold H. Tenney, GMX-1.

Annual Symposium of New Mexico Section, American Vacuum Society, Albuquerque, N. M., April 20-22:

"The Application of a Digital Computer to a High-Speed Residual Gas Analyzer" by Norman G. Wilson, K-1, and Dean E. McMillan, K-3.

Colloquium, Physics Department, University of Illinois, Urbana, Illinois, April 21:

"Use of Nuclear Explosives for Nuclear Physics Experiments" by Benjamin C. Diven, P-3.

Presentation at Arizona State University, Tempe, Arizona, April 19; University of Illinois, Urbana, Illinois, April 22:

" Present Status of the Los Alamos Meson Factory" by Darragh E. Nagle, MP-4.

American Physical Society Meeting, Columbus, Ohio, April 23:

"Vibration Rotation Bands of $^{15}N^{18}O$" by James L. Griggs, Prof. K. Narahari Rao, both Ohio State University, L. H. Jones and R. M. Potter, both CMF-4.

Rio Grande Chapter of Association of Computing Machinery, Cloudcroft, N. M., April 21-22:

"Computer Experiments in Fluid Dynamics" by John P. Shannon, T-3.

"Safety Aspects of Digital Control of a Nuclear Reactor" by Howard B. Demuth, K-4.

Presentation at John Hopkins University, Applied Physics Laboratory, Silver Spring, Maryland, April 29:

"Meson Factories" by Louis Rosen, MP-DO. (Invited paper)

Meeting of New Mexico State Society of Medical Technologists, White Winrock Hotel, Albuquerque, N. M., April 29:

"Technical Writing" by Helen M. Miller, H-5.

Joint Meeting, Southwestern and Rocky Mountain Division of the American Association for the Advancement of Science and the New Mexico Academy of Science, New Mexico State University, Las Cruces, N. M., May 1-4:

"Radiochemical Separation Technique for Isolation of Short-Lived Cerium Isotopes from Fission Products" by Darleane C. Hoffman, J-11.

"Radiochemists and Nuclear Chemists: One Species or Two?" by J. D. Knight, J-11. (Invited paper)

Electrochemical Society Meeting, Graphite Symposium, Cleveland, Ohio, May 1-5:

"The Stress Dependence of the Creep Rate of Two Commercial Graphites" by Walter V. Green and Eugene G. Zukas, both CMF-13.

Conference on Isochronous Cyclotrons, ORNL, Gatlinburg, Tenn., May 2-5:

"Los Alamos Meson Factory: Present Status and Future Plans" by Donald C. Hagerman, MP-2. (Invited paper)

Panel Discussion of Some Automatic Methods of Lens Design, Society of Motion Picture and Television Engineers, Washington, D. C., May 3:

"Designing Lenses with a Computer" by Charles A. Lehman, Sr., T-5. (Invited paper)

Colloquium, Montana State University, Bozeman, Montana, May 4:

"Cross Section Measurements Made with Neutrons from an Underground Nuclear Explosion" by Edward R. Shunk, W-8. (Invited paper)

International Symposium on the Decontamination of Nuclear Installations, Atomic Energy Research Establishments, Harwell, England, May 4-6:

"Decontamination Experience in the Design and Operation of the Plutonium Processing Facilities at Los Alamos" by E. L. Christensen, W. D. McNeese and W. J. Maraman, all CMB-11. (Invited paper)

American Welding Society Conference, Palo Alto, Calif., May 5-7:

"Ceramic-Metal Brazes for Use at 1100°C" by Gale S. Hanks, Robert S. Kirby and John D. LaMotte, all CMB-6. (Invited paper)

International Symposium on Development in Irradiation Capsule Technology, Pleasanton, California, May 3-5:

"An Irradiation Capsule for Molten Pu Alloys" by P. J. Peterson, CMB-11.

"The Irradiation of Liquid Plutonium Fuels in a Thermal Reactor" by R. L. Cubitt, G. L. Ragan, and D. C. Kirkpatrick.

Colloquium, Physics Department, University of New Mexico, Albuquerque, N. M., May 6:

"Quasi-Stellar Objects" by James Terrell, P-DOR. (Invited paper)

Joint American Nuclear Society-American Ceramic Society Symposium on Nuclear Applications of Non-Fissionable Ceramics, Washington, D. C., May 8-11:

"The High Temperature Chemistry of Non-Fissionable Ceramics" by Melvin G. Bowman, CMB-3. (Invited paper)

U.S. AEC Joint Traffic Management Conference, Las Vegas, Nevada, May 10-12:

"Member Report on Atomic Energy Industry Traffic Conference" by Horace E. Noyes, SP-DO. (Invited paper)

Ninth Modulator Symposium, Fort Monmouth, N. J., May 11-12:

"Fault-Protection System for Linac RF Amplifiers" by James D. Doss, MP-2. (Invited paper)

"Hard Tube Modulators for the Los Alamos Meson Facility" by Robert W. Freyman, P-1. (Invited paper)

Presentation at Seminar, University of Missouri, Rolla, Mo., May 12:

"Vibrations of Disordered Lattices" by William M. Visscher, T-9.

Staff Seminar: Armed Forces Radiobiology Institute, Division of DASA, Bethesda, Md., May 12:

"Science and Safety" by Roy Reider, H-3. (Invited paper)

Annual Conference, American Industrial Hygiene Association, Pittsburgh, Pa., May 16-20:

"Evaluation of Particle Sizing Techniques; Comparison of Computer Sizing Programs" by S. Posnar, Lovelace Foundation, and Harry J. Ettinger, H-5.

British Nuclear Energy Society Conference on Fast Breeder Reactors, London, England, May 17-19:

"Fast Reactor Development in the United States—Los Alamos Molten Plutonium Program" by Merrill J. Whitman, USAEC, Division of Reactor Developments and Technology, Fred Leitz, General Electric, San Jose, Calif., and William H. Hannum, K-1.

Presentation at USAMUCOM, Conference on Radiation Effects on Explosives, Picatinny Arsenal, May 18-20:

"Effects of Nuclear Radiation on Organic Explosives" by Edward D. Loughran, GMX-2.

"The Vulnerability of Organic Explosives to Pulses of Nuclear Radiation" by Louis C. Smith, GMX-2. Classified meeting.

Presentation at Luncheon Meeting, American Heart Association, The Lodge, Los Alamos, N. M., May 21:

"The Changing Nature of Biomedical Research" by Wright H. Langham, H-4.

Fourteenth Annual Conference on Mass Spectrometry and Allied Topics, Dallas, Texas, May 22-27:

"Studies of Partial Molar Quantities at High Temperatures Using a Mass Spectrometer" by E. K. Storms, CMB-3. (Invited paper)

Fifteenth Annual AEC Corrosion Symposium, Oak Ridge National Laboratory, Oak Ridge, Tennessee, May 23-27:

"Removal of ^{137}Cs from Molten Sodium by Means of Getters" by Joseph C. McGuire, K-2.

"Irradiation Performance of Plutonium-Cobalt-Cerium Alloys" by by J. A. Basmajian and Louis D. Kirkbride, both K-2.

"Mass Transfer of Ta in Molten Pu-Co-Ce Fuels—The Linear Mass Transfer Experiment" by John C. Biery and Carl R. Cushing, both K-2.

"A Comparison of Three Methods of Oxygen Concentration Measurements in Sodium" by C. C. McPheeters and J. M. Williams, both K-2.

"Behavior of Liquid Pu-Co-Ce Alloys in Contact with Sodium—Out-of-Pile Fuel Pin Venting Experiments" by J. C. Clifford, K-2.

"Studies of the Kinetics of Zirconium Hot-Trapped Sodium Systems—Progress Report" by J. M. Williams, K-2.

Twenty-Second High Temperature Fuels Committee Meeting, Westinghouse Astronuclear Laboratory, Large, Pa., May 24-26:

"Irradiation of Liquid Pu-Co-Ce Alloys (6.2 g/cc Pu) Contained in Tantalum Capsules" by John A. Basmajian, K-2.

"Mass Transfer of Ta in Molten Pu-Co-Ce Fuels—The Linear Mass Transfer Experiment" by John C. Biery and Carl R. Cushing, both K-2.

"Melt-Freese Thermocycling" by L. A. Geoffrion and R. H. Perkins, both K-2.

"Solid Plutonium Fuel Materials" by J. A. Leary, CMB-11.

new hires

Lavon Roy Biswell, Las Vegas, Nevada, J-17 NRDS.

Pauline V. Ungnade, Los Alamos, N.M., MP-DO (Casual).

Rodger D. Blake, Los Alamos, CMB-6.

Beverly D. Rutledge, Los Alamos, J-1 (Casual).

Stephen M. Yabroff, Berkeley, Calif., WSD.

Mary A. W. Fleming, Los Alamos, PER-1 (Casual-Rehire).

Arthur W. Mayne, Nimbus, Calif., J-10.

Harold V. De Haven, Denver, Colorado, MP-2.

Jerry W. Cummings, Albuquerque, N.M., MP-3.

Daniel C. Holterman, Espanola, N.M., SP-3 (Short Term).

Joseph J. Prabulos, Jr., Lafayette, Ind., K-1.

Lyle E. Edwards, San Jose, Calif., GMX-2.

Peter Velarde, Jr., Santa Cruz, N.M., GMX-3.

Ronald D. Strong, Los Alamos, GMX-1.

Jerold D. Whitcomb, Albuquerque, N.M., ENG-1 (Rehire).

Gregory M. Kelley, Boston, Mass., J-11.

Jose Augustine Arellano, Dixon, N.M., GMX-4.

Walter Franklin David, Jr., Amarillo, Texas, ENG-2.

Dolores M. Lazzaro, Los Alamos, J-1 (Casual-Rehire).

Mark Daehler, Madison, Wisconsin, P-15.

Joanne H. Montague, Los Alamos, H-4.

Scott T. Bennion, Idaho Falls, Idaho, J-15.

John C. Lucas, Jr., Livermore, Calif., SD-2.

Claude M. Gillespie, Jr., Columbus, Ohio, T-2.

Howard L. Daley, Pasadena, Calif., P-9.

Mauricio P. Martinez, Jr., Chimayo, N.M., SP-8 (Short Term).

YEARS AGO IN LOS ALAMOS

Culled by Robert Porton from the June 1946 files of the LOS ALAMOS TIMES

Commissary Restricted to Residents

To insure Los Alamos residents the most adequate food supply possible, starting Monday morning, purchases in the Commissary will be restricted to those persons who actually reside on the Project. No person who lives off the Hill, including commuting Project employes, will be permitted to make purchases.

Water Shortage Threatens Hill

Unless Los Alamos residents make an immediate and drastic curtailment in their use of water, the supply will be depleted by July 25. This flat prediction was made by F. S. Tew, administrative assistant in the Operations Division, the man who has the most intimate knowledge of the Hill's water problems. The water situation here is so critical that the official advanced the possibility that a waterless period for the Hill may be inevitable, no matter how drastic water consumption is cut by the residents. Also foreseen was the possibility that the Hill's supply of electric power may be reduced by the acute water shortage.

Bikini Test To Climax Work Done Here

As jittery as a first-night audience made up of the cast's relatives, will be the people of Los Alamos at 4:30 Sunday afternoon, the hour when the atomic bomb is scheduled to be dropped at Bikini. At that dramatic hour, actually Monday morning in Bikini, a tiny coral atoll will be the center of the world. Los Alamos scientists and technicians at Bikini number only a few—150—compared to the 42,000 members of the Joint Army-Navy Task Force One, but from the beginning, the Hill people have played a key roll in making possible the test.

Beer Cut To Five Cents A Bottle

What this country needs, even more than a good five-cent cigar, is a nickel bottle of beer—and Los Alamos has it, temporarily. This week, when the Service Club slashed its price on beer to five cents a bottle, civilians and GI's have been generous in their praise of the move. They don't question where or how; they just like the idea. The special price was placed because, with summer beer sales soaring, the Army has exceeded its permissible five per cent profit. This week, the Tech PX also reduced prices on tobacco to a few cents a package, with cigarettes reduced to five cents a pack.

what's doing

OUTDOOR ASSOCIATION: No charge, open to the public. Contact leader for information regarding specific hikes.

- Thursday, June 2, night hike. Liz Gittings, leader.
- Saturday, June 4, Cholle Canyon. Marlene McKee, leader.
- Tuesday, June 7, night hike. Pauline Ungnade, leader.
- Saturday, June 11, Pueblo-Bayo Canyons. Bob Skaggs, leader.
- Sunday, June 12, Santa Fe Baldy. Ken Ewing, leader.
- Thursday, June 16, night hike. Ken Ewing, leader.
- Sunday, June 19, Gold Hill. Terry Gibbs, leader.
- Tuesday, June 21, night hike. Virginia Winsor, leader.
- Saturday, June 25, Mt. Wheeler. Ken Ewing and Terry Gibbs, leaders. Less strenuous hike also planned to Williams Lake on Mt. Wheeler. Mike Williams, leader.
- Thursday, June 30, night hike. Terry Gibbs, leader.
- Tuesday, July 5, night hike. Mike Williams, leader.

PUBLIC SWIMMING: Los Alamos High School Pool, Adults 35 cents, children 15 cents. Saturday and Sunday 1 to 6 p.m. Monday, Tuesday, Wednesday and Thursday, 7:30 to 9:30 p.m.

MUSEUM OF NEW MEXICO: Buildings in Santa Fe open from 9 a.m. to 5 p.m. Tuesday through Saturday; 2 p.m. to 5 p.m. Sundays and holidays. Closed Mondays.

- Museum of International Folk Art—"Afro-Arabic," "The Shape of Music," "German Stoneware," all month; Folk Art Auditorium, 8 p.m., June 19, demonstration and film on Japanese wood block printing and Japanese sand painting by Mr. and Mrs. Thoshi Yoshida, Tokyo, Japan, sponsored by the International Folk Art Foundation, admission free.
- Fine Arts Building—"The Rain Cloud Callers," opens June 5; "Original Drawings by Bill Mauldin," closes June 26; "The Artists' Record: Northern New Mexico," all month.
- Palace of the Governors—"Prehistoric Southwest Indian Civilizations from Ice Age to 1700," and "Southwestern History: Spanish-Colonial and Territorial Periods," all month.

The man with the four-story reach is Gerson Romero of The Zia Company's janitor section.

Henry T. Motz
3187 Woodland
Los Alamos, New Mexico 87544